This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

B 433246

THE UNIVERSITY OF MICHIGAN · LIBRARIES ·
THE UNIVERSITY OF MICHIGAN
1817

THE UNIVERSITY OF MICHIGAN · LIBRARIES ·
THE UNIVERSITY OF MICHIGAN
1817

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

APPLE CULTURE

AND DISTRICT LISTS OF APPLES SUITABLE FOR ONTARIO AND QUEBEC

WITH

DESCRIPTIONS OF VARIETIES

BY

W. T. MACOUN

Horticulturist, Central Experimental Farm

BULLETIN No. 37

APRIL, 1901

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE

Packing Apples for Export in Niagara District, Ontario.

133
.E22
no.37-60

GENERAL BOOKBINDING CO.
72 433AA A 30
QUALITY CONTROL MARK
Ash. Bind
4115

TABLE OF CONTENTS.

	PAGE
Apple culture in the provinces of Ontario and Quebec	8
Apple culture at the Central Experimental Farm	8
Introduction of varieties	9
Origin of varieties	9
Seedling varieties	10
Cross-bred and hybrid varieties	11
Bud-varieties	16
Propagation by grafting and budding	17
Tools and appliances used in pruning and grafting	24
The nursery	25
The orchard	26
Site and soil	26
Preparation of the land	27
Time of planting	27
Laying out the orchard	28
Windbreaks	28
Kind of trees to plant	29
Planting	30
Varieties	32
A district apple list for the provinces of Ontario and Quebec	33
Description of varieties	37
Russian apples	47
Pollination of apples	48
Pruning	49
Maintenance of fertility	51
Cultivation	55
Cover Crops	57
Renovating orchards	60
Picking and packing	61
Storing	63
Markets	64
Spraying	65
Diseases and other injuries to apples and apple trees	67
Apple insects	70

To the Honourable
The Minister of Agriculture.

SIR,—I beg to submit for your approval Bulletin No. 37 of the Experimental Farm series, which has been prepared under my direction by Mr. W. T. Macoun, Horticulturist of the Central Experimental Farm.

The subject treated of is Apple Culture and the information presented has been derived mainly from the experimental work carried on in connection with apple growing at the Central Farm during the past twelve years. In this bulletin there will be found full information as to the best methods of preparing the soil for an orchard, with particulars also as to the planting and subsequent care of the trees. Instructions are also given as to pruning, grafting and on many other topics relating to this branch of the fruit industry. Lists of varieties of apples are submitted which ripen at different seasons and which are suitable for planting in different parts of Ontario and Quebec and full descriptions as to the character and quality of these varieties are also given. Some of the diseases to which apple trees are subject are also referred to, and a brief account is given by Dr. James Fletcher, Entomologist and Botanist to the Experimental Farms, of some of the more important insects which are injurious to the apple.

It is hoped that the information submitted will be useful to those interested in the cultivation of this fruit in Canada, that it will prove a stimulus to further planting both for home use and export, and that it may aid in making the growing of apples in this country more successful and more profitable.

I have the honour to be,

Your obedient servant,

WM. SAUNDERS,

Director Experimental Farms.

OTTAWA, April 1, 1901.

APPLE CULTURE

BY

W. T. MACOUN,

Horticulturist, Central Experimental Farm, Ottawa.

The apple is the most important and useful fruit in all civilized parts of the north temperate zone where it can be grown successfully. While other fruits are, in a greater or less degree, regarded as luxuries, the apple is part of our regular diet and much would this wholesome and delicious fruit be missed were we unable to procure it.

The origin of the cultivated apple is wrapped in mystery. It is supposed, however, that it had its beginning in the wild apple of Europe (*Pyrus Malus*), but there is no evidence to show when the improvement began, nor when the fruit reached the size, colour and quality of what is regarded as a good apple to-day. It is known, however, that at the beginning of the Christian era, the Romans cultivated a few varieties of apples which might compare favourably with some that are grown at the present time. Although the apple is mentioned in Holy Scripture many years prior to that period, it is now thought that the word referred to another fruit, or other fruits, and not to what is now called an apple.

While the range of successful culture of many other fruits is comparatively limited, the apple has a very wide one in the temperate climates of the old and new worlds and is able to accommodate itself to conditions under which many other cultivated fruits would not thrive. It is, however, in the temperate parts of America where it reaches the highest state of perfection, and where there is an ever increasing area devoted to this fruit. Named varieties of apples are very numerous, being, probably, over 2,500 in number, so that every taste, no matter how eccentric, may be satisfied, and a selection made of those best suited to a particular person or place. It is a very attractive fruit, the red and yellow, which are the predominant colours, varying much in shade and prominence.

No other fruit, probably, has as long a season as the apple. By a judicious selection of varieties, apples may be had in good condition the whole year round, and now that the system of cold storage has been so perfected, some of the best varieties, which, under ordinary circumstances, would not keep until spring, may be had in good order late in the following summer.

The uses of the apple are too well known to need mention. Truly, this is the king of fruits.

The profits from apple growing may be large or may be small; much depending on the varieties planted, the markets, and most of all on the man and his methods of growing this fruit. Some varieties begin to bear paying crops when five years planted. Most of the best sorts, however, do not bear heavily for ten years or more. The profitable life of an apple tree will depend

greatly on the climate it is grown in, the culture given, and the variety. There are, however, other factors which influence it. In the best apple districts of America, profitable crops are gathered from trees sixty to one hundred years of age.

APPLE CULTURE IN THE PROVINCES OF ONTARIO AND QUEBEC.

It was not until forty or fifty years ago that the apple industry began to assume much importance in the province of Ontario, although apples had been grown there since the early years of the 19th century, and probably before. Apple culture has increased very rapidly during recent years and continues to make steady growth. From the statistics for 1900, we learn that the yield of apples for that year was estimated at 36,993,017 bushels; that there were 6,518,048 trees of bearing age, and 3,430,670 young trees in the province. The export of apples from this province is also very large.

In the province of Quebec, apples have been grown for a much longer period than in Ontario. There are records which show that as long ago as 1663 this fruit was being produced there. While the industry has not grown as rapidly as in Ontario, there are now many large orchards in the province, and the area devoted to this fruit is increasing every year and more apples are being exported. On the Island of Montreal, alone, there are now about 2,400 acres of orchard of which most of the trees are apples, and the product is estimated at from 250,000 to 275,000 barrels annually. The future of the apple industry in Canada seems very bright. The best flavoured, most highly coloured and longest keeping fruit is produced in Canada. Apples can be grown successfully on a large scale in the provinces of Ontario and Quebec from latitude 42° to latitude 45°, and from below the city of Quebec west to the great lakes; an immense tract of country which, although not all suitable for apple growing, will furnish enough good land to produce all of this fruit that will be required to supply the world for many years to come.

While it is doubtful whether apples can be grown economically for export in the provinces of Ontario and Quebec on a large scale much north of latitude 45°, they have been grown as far north as latitude 48° 26′, at Chicoutimi, in the province of Quebec, and there is every reason to believe that they can be grown even further north than this in both provinces, if only the hardiest varieties are planted and better care taken of the trees than in the more favoured districts. These northern orchards will probably be able to supply all the local demand, and perhaps more.

The market for good apples in Great Britain and Europe is at the present time practically unlimited and will probably be so for a long time.

With the favourable conditions for growing apples which prevail in this country, Canadian apples should take first place on the markets of the world, if the proper kinds of fruit are grown, and if it is placed on the markets in prime condition.

APPLE CULTURE AT THE CENTRAL EXPERIMENTAL FARM.

Most of the information contained in this Bulletin is the result of the experience gained in growing apple trees and apples at the Central Experimental Farm. The notes on apple insects and the remedies therefor, which will be found in the closing pages of this Bulletin, have been kindly prepared by Dr. James Fletcher, Entomologist and Botanist of the Dominion Experimental Farms, to whom I beg to acknowledge my indebtedness.

The lines of work at the Central Experimental Farm have included the testing of the hardiness, productiveness, quality and freedom from disease of the different varieties of apples. The different methods of propagating and grafting have also been tested, using various stocks for this purpose. The top-grafting of tender varieties on hardy stocks has received much attention of late years and good results are already apparent. Different methods of culture have been tried in the orchard and various cover crops have been tested to ascertain which were the best.

Spraying has been a prominent feature of the work since 1890, and many experiments have been tried with different mixtures and solutions for preventing and destroying insect pests and fungous diseases.

The apple orchards at the Central Experimental Farm were begun in the autumn of 1887, but it was not until the spring of 1888 that much progress was made. Since that time the number of varieties tested and the area devoted to this fruit have both increased very much. Up to the present time 645 varieties have been tested, most of which are now growing, though many of the kinds have been replaced several times. The Russian apples have received especial attention, as it was thought that these would prove of particular value for the northern parts of this country. There are now about 160 Russian varieties growing, though some of them may be synonyms. There are 1,271 apple trees in the orchard at present, occupying about 18½ acres of land.

In addition to this there is a Russian seedling plantation, occupying about an acre, and a small orchard of Wealthy apple trees alone.

Much work has also been done in cross-breeding and hybridizing apples for the purpose of obtaining hardier trees or better varieties.

INTRODUCTION OF VARIETIES.

Many varieties of apples have been tested in Canada and the United States since these countries were first settled, and during the last century, especially, the number has increased very rapidly. These have either been introduced from Great Britain and Europe or have been originated in America. It has been found that a much larger proportion of the varieties which have originated in America, are more profitable sorts to grow than of those from other countries, and in Canada the facts are much the same, except in the very coldest parts of the country, where apples can be grown, and there the Russian varieties take a predominant place, but this is probably because the colder parts of the country have not been settled so long, and hardy seedlings of value are, on this account, not so often met with.

During the past thirteen years, 645 varieties of apples have been tested at the Central Experimental Farm, at Ottawa. These have been obtained from many sources, but the largest proportion of them were of Russian and American origin.

Of the apples which are succeeding best at Ottawa, nearly all the most profitable summer varieties are of Russian origin, but most of the best autumn and winter sorts were originated in America.

ORIGIN OF VARIETIES.

Varieties are originated in three different ways. First, from seed; second, by cross-fertilization and hybridization; and third, by sporting or bud variation.

SEEDLING VARIETIES.

Most of the named varieties of apples growing in America to-day were originated as seedlings. Our forefathers brought apple seeds with them from the old land and sowed them in this country. The young trees raised from these grew up and bore fruit, and occasionally a variety of merit would thus be produced, and then propagated. In later times chance seedlings grew up in the fence corners and other waste places, and these also bore fruit and added their quota of good sorts. From trees like these have originated such fine varieties as Northern Spy, Baldwin, Fameuse, McIntosh Red, and many others.

Of late years more systematic efforts have been made to originate new varieties from seed. But the varieties of really useful apples which have originated in this way have been very few indeed. The late Peter Gideon, of Excelsior, Minn., U.S., devoted probably more time to this work than any other man in America. He published the results of his experience in the Thirteenth Annual Report of the Minnesota State Horticultural Society. The following are extracts from that report :—

'Our efforts and trials in Minnesota began thirty years ago last spring by planting one bushel of apple seed, a peck of peach seed, and five hundred apple, pear, plum and cherry trees, and for eleven years thereafter planted each year enough apple seed to bring 1,000 trees, and in the time named frequent additions to the orchard of old named varieties—all southern or eastern grown trees and seeds, and all kept as long as they could be made to live in Minnesota, and to-day only two trees remain. One of these, the Wealthy, grown from a cherry-crab seed, obtained of Albert Emerson, of Bangor, Maine, of whom I obtained scions at the same time, from which I grew the Duchess, Blue Pearmain, and the Cherry-crab, all of which, combined, were the foundation of Minnesota horticulture, that to-day is the pride and hope of the North-west. But since these varieties came into bearing we have planted only of our own growing of seed, with forty first-class varieties the result.'

'Thus far it has taken from three to five hundred seedlings to give us one first-class apple, and that from seed taken from the best apples we had.'

Although the Wealthy apple is probably the most valuable variety of its season in the colder parts of Canada and the United States, Gideon's attempts to produce a hardy late keeping apple of very good quality were of no avail, and at the present time it is not known that any very good late keeping dessert apple exists which is adapted to the climate of Minnesota, or for the colder districts in Canada.

At the Central Experimental Farm at Ottawa, considerable work has been done in raising seedling apples, especially from seed of Russian varieties, but no kinds of great merit have yet been produced.

In the year 1890 an orchard was planted comprising about 3,000 trees grown from seed imported from E. Goegginger, Riga, Russia. The seed from which these were grown was said to have been taken from apples grown north of Riga, Russia. Of these there are now 898 remaining, the rest having been killed by blight or winter or removed on account of weak growth or inferior quality. These began to fruit in 1897, when about 50 trees bore. In 1898 there were 40 trees which fruited ; in 1899 there were 43, and in 1900 there were 26, making a total of 159 trees which have borne fruit. None of these apples are sufficiently promising to be worthy of special mention,

but a few of them are as good as the majority of the named Russian varieties. Nearly all of them are summer apples.

Many seedlings are now being grown of the best varieties of apples which have fruited at Ottawa, and it is hoped that some good varieties will be originated in this way.

From our own experience and the experience of others, it would appear that if a good late keeping apple is desired, the chances are very slight that it will be produced from seeds of an early apple. On the other hand, seeds from a late keeping apple will not, necessarily, produce late keeping varieties. Apples have been so inter-crossed, in nature, for hundreds of years, that the characteristics of many varieties are apparent in the seedlings of one. It is possible that there never was a case where a seedling of a cultivated variety of apple was identical in every respect with its parent. If it is desired, then, to originate a new variety, the following methods are recommended as being the most likely to produce the variety with the characteristics sought for, although thousands of seedlings may have to be grown to attain this purpose:—

1. To produce a hardy apple where no apples have yet been found hardy: Sow seeds of apples which have ripened in a climate as nearly similar as possible.

2. To produce a hardy long keeping apple of good quality: Sow seeds of long keeping apples of good quality which have ripened in a similar climate.

3. To produce an apple having certain characteristics, as regards hardiness, vigour and productiveness of tree, and quality, size and appearance of fruit: Sow seeds of varieties having most of the characteristics desired.

4. If seedlings are to be grown on a large scale, more varieties having the characteristics desired will probably be obtained if trees of several named sorts blossoming at the same time be planted in close proximity in the orchard, and the seeds used from fruit borne on these trees. The trees thus planted should combine all the good points in the standard aimed at, for the variety to be originated.

Apple seeds germinate best when sown in the autumn. If, however, it is not convenient to sow them at that time they may be stratified; that is, mixed with sand, slightly moist, but not wet, and kept in a cool but dry place until spring. Seeds should not be sown in the autumn in soil which heaves much; better hold them over and sow them as early in the spring as the soil can be worked. If apple seeds become very dry they may not always germinate satisfactorily, and this should be guarded against. The seed should be sown thinly, about two inches deep, in rows from 2½ to 3 feet apart. Or, if the quantity is small, beds may be prepared and the seed sown in row about 6 inches apart. If sown in the autumn, most of them should germinate the following spring, and make a growth of from one to two feet that season. They should be transplanted the following spring into rows from 2½ to 3 feet apart, placing them 12 inches apart in the rows. The next spring they should be in good condition for planting in the seedling orchard.

CROSS-BRED AND HYBRID VARIETIES.

Those varieties which are originated by artificial cross-fertilization and hybridization are called cross-bred and hybrid, respectively. A hybrid is a cross between two species: as, for instance, between *Pyrus Malus*, the apple, or a variety of it, and *Pyrus baccata*, the Siberian crab. A cross-bred is a

cross between two varieties of the same species, as, for instance, between the Northern Spy and McIntosh Red apples.

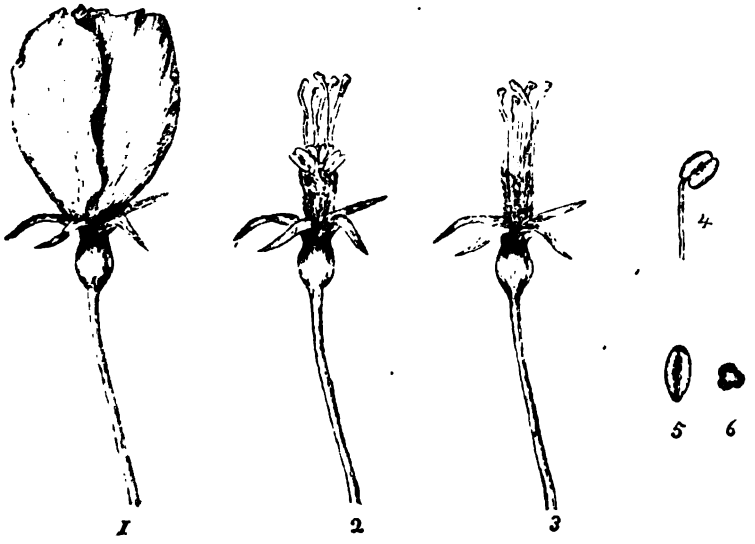
Although nearly all our best apples have been originated as seedlings, the reason is, not that good varieties cannot be produced by artificial cross-fertilization and hybridization, but that comparatively little systematic work has been done in this direction in America until recent years. When one considers that a very large number of chance seedlings have been the result of the natural cross-fertilization of the flowers of different varieties (for it is now an established fact that many varieties of apples are self-sterile) it is reasonable to suppose that a much larger percentage of good apples will be obtained if the flowers are pollinated artificially, as then only the varieties which have the characteristics desired in the seedlings will be used as the parents, and although it has been already said that apples have been so inter-crossed in nature for hundreds of years that there is no certainty what the seedlings of any variety will be like, yet the characteristics of the parents will be more likely to predominate than those of varieties whose blood has intermingled at a more remote period. Before beginning any work of this kind, it is important, then, to decide what kind of an apple is most desired, and to select as parents those varieties which have as many of the qualities sought for as possible. The seedlings raised will probably have more of the characteristics of the female parent than of the male, and this should be taken into consideration when selecting the variety for that purpose. There is, however, no certainty in the matter, and in originating cross-bred apples it is wise to do some crossing with one variety as the female parent, and some with the same variety as the male parent. A hybrid, however, is almost certain to partake more of the female parent if the species differ widely.

The season when one may pollinate apple blossoms is very limited, as there is only from a week to ten days during which the work may be done.

In the blossom of the apple the organs of reproduction represent both sexes. When the pollen, which is the fine dust constituting the male part of the flower, comes in contact with the stigma, which is the upper part of the female organ, fertilization is liable to take place, and this must be prevented if artificial pollination is to be performed. The pollen which is contained in the anthers is shed almost as soon as the blossoms open, and work must begin, therefore, when the flower is in bud.

There are usually five or six buds in a cluster on apple trees, but generally only the strongest of these set fruit. The more the flower bud is developed, the greater chances there will be that artificial pollination will be successful. The operator, however, must be certain that no pollen has already been shed. Two or three of the weakest and least developed buds are pinched off and the remainder are left to be operated upon, or if some of the flowers are open they are removed and the others left. A pair of small tweezers are very good for this purpose. They should be perfectly smooth at the tips, both outside and inside, so that no pollen will lodge there. The petals of the buds are now removed by means of the tweezers; the anthers which contain the pollen are then removed, by breaking the filaments off, and thrown away. In removing the petals and anthers, great care should be taken that the stigmas are not injured, as, if they are, failure is certain. Only the female part of the flower now remains. The stigmas are in condition to receive the pollen when they become moist. They will remain in this condition for a day or two. Pollen may, however, be applied to the stigmas before they are ready, as pollen will stay in good condition longer than the stigmas. If the pollen is not applied

immediately, the flowers which have been operated upon should be covered with a stout paper bag and the mouth tied tightly about the twig, so that no insect can get in. Flower clusters of the variety of apple which is to supply the pollen and be the male parent of the future seedlings, should be gathered just before the buds open, and the twigs put in water until the blossoms open and the pollen is shed, which can be easily detected as the anthers burst open, when the pollen becomes quite visible to the naked eye. If the flowers are taken in the orchard after they open there is every probability that insects may have deposited pollen from other varieties there, and thus the parentage of the cross-bred variety would not be certain. When the pollen and stigmas are ready, the bag is removed and the stigmas then well covered with the pollen. This may either be effected by holding the flower in the fingers and rubbing the anthers against the stigmas, by putting some of the pollen on the finger nail and thus rubbing it on, or by applying it on the end of a knife or some other flat surface. The camel's hair brush which is often recommended is not a safe thing to use, as pollen may stick in the hairs, and if several kinds are worked with there will be no certainty as to the parentage. After this operation has been performed the bag should be put on again and tied tightly as before. A label should then be attached to the twig, on which should be written a number, the names of the male and female parents, the number of flowers operated on, and the date on which the work was done. This record should also be kept in a notebook. When the blossoming period is over and the fruit is well set the paper bag should be removed, a record taken of the number of apples which have set, and then a gauze or muslin bag tied over the fruit instead of the paper one. The apples should then be left to grow and ripen in the orchard. Late apples which are not thoroughly matured when harvested should be left as long as possible before the seeds are taken out. The seeds should be removed, however, in time to sow them before winter sets in. They should be counted and the number recorded with the other data, and then treated the same as has already been recommended in the paragraph on Seedling Varieties.



Flower of apple prepared for cross-fertilizing—1, flower just before opening; 2, the petals removed; 3, the anthers removed; 4, one of the anthers; 5 and 6, views of pollen highly magnified.

Much systematic work has been done in Canada in originating varieties of apples by cross-fertilization and hybridization. To the late Chas. Arnold, of Paris, Ont., and to the late P. C. Dempsey, of Trenton, Ont., is due great

credit for work done at a time when few were interested in the scientific aspects of fruit growing. The Ontario apple, which was originated by Chas. Arnold by crossing the Northern Spy with the Wagener, is a worthy memorial to that gentleman, it being one of our best and most profitable commercial apples. The Trenton and Walter apples are two of Mr. Dempsey's crosses, and are among the best apples of their season. The late horticulturist of the Central Experimental Farm, Mr. John Craig, also did some work in this direction, and it is expected that his crosses will begin to fruit next year. During the past two years we have done a limited amount of work also, the object being to obtain, if possible, hardy, late-keeping, productive apples of fine colour and good quality, which are much needed in northern and eastern Ontario and the Province of Quebec. Both seasons the McIntosh Red and Lawver apples have been used for this work. They are good sized red apples, and are perfectly hardy at Ottawa, being also annual, though not heavy, bearers. The McIntosh Red apple is probably unsurpassed in quality by any apple of its season. The Lawver apple is the best keeping apple yet fruited at the Central Experimental Farm, it having been kept in good condition in an ordinary cellar for over a year. Both of these apples have been used as the male and female parents, and it is hoped that an apple will be originated from them which will supply a long felt want in the colder parts of the country. The most comprehensive and extensive work of this kind, however, has been done by Dr. Wm. Saunders, Director of the Dominion Experimental Farms, and by his son, Dr. C. E. Saunders. While it is too soon yet to judge of the full value of this work, the results have been so satisfactory and encouraging thus far that there is good reason to believe that some of the varieties which have already fruited will prove hardy in places where the ordinary apple or crab apple will not survive the winters.

The following extract from the Director's Annual Report for 1899 will give some idea of the scope and results of this work :—

'During the spring of 1887, shortly after the work of the Experimental Farms was begun, a number of varieties of seeds was kindly forwarded to the director by the late Dr. Regel, who at that time had charge of the Royal Botanic Gardens at St. Petersburgh, Russia. Among these was a package of the seed of *Pyrus baccata*, a wild form of crab apple known as the berried crab, a native of the northern parts of Siberia. Young trees were grown from this seed, and in 1890 and 1891 specimens were sent to the Experimental Farms at Brandon, Manitoba, and at Indian Head, North-west Territories, to test their hardiness in those localities. These trees have been found quite hardy at both of these western Experimental Farms, and have started from the terminal buds on the branches every year since they were planted.

'As this was the only form of the apple which had proven hardy in the Canadian North-west, after several years experience had established its hardiness, a series of experiments were instituted to improve the size and quality of the fruit, which in its native form is not much larger than a cherry, and is often quite astringent. The trees, however, bear fruit abundantly.

'In the spring of 1894 this small wild crab was crossed with several varieties of hardy apples such as Tetofsky and Wealthy, also with some of the larger crabs, including Transcendent, Orange and Hyslop. The seeds obtained from these crosses were sown in the autumn of that year and germinated the following spring, producing in all about 160 thrifty young trees. These were planted the next year in a small orchard, in rows 5 feet apart each way. Some of them have grown very rapidly and have made shapely young

trees. During the past season (1899) 36 of these trees have fruited and some of them have borne heavy crops. The fact that so many of these cross-bred trees have fruited on the fourth year from the sowing of the seed is very encouraging and indicates a very early bearing habit. Of the 36 trees which have fruited this year, five have borne fruit of such size and quality as to justify their being named and propagated. Several others among those which have fruited are promising and will be further tested. Most of those of less promise have been dug up and destroyed, so as to give the remaining specimens more room. Following are the names and descriptions of the five varieties referred to, given in what is believed to be the order of their merit.

'*Charles.*—A cross of Tetofsky male on *Pyrus baccata* female. Tree a very upright and vigorous grower with large leathery leaves. The blossoms are deep pink in bud, pinkish white when open, large with wide petals. The fruit set well and the tree was fairly well laden, the fruit being distributed very evenly over the tree. It was ripe September 3, size $1\frac{9}{16}$th inches across, $1\frac{6}{16}$th inches deep, very distinctly ribbed. Colour a uniform yellow, very attractive. Flesh yellow, solid, crisp, juicy, mildly acid with a pleasant flavour, and slightly astringent. The skin is thin and the fruit bakes well. When compared with the Transcendent crab, the size was practically the same, and the acidity and astringency a little less; stem long, calyx persistent.

'*Novelty.*—A cross of Wealthy male on *Pyrus baccata* female. Tree fairly upright and a vigorous grower with good foliage. On this tree there were only a few bunches of blossoms, which were deep pink in bud, white when open, flowers large, petals broad. Fruit ripe September 19. Size, $1\frac{1}{2}$ inches across and $1\frac{1}{4}$ inches deep, smooth, colour deep red. Flesh a pale yellowish pink, firm, crisp and juicy, sub-acid and of fair quality. Stem long, calyx usually persistent; bakes well. The largest and best of the Wealthy crosses which have yet fruited.

'*Aurora.*—A cross of Tetofsky male on *Pyrus baccata* female. Tree a vigorous grower, upright in habit, leaves large, thick and leathery, blossomed freely. Flowers deep pink in bud, large when open and pure white, petals broad. The fruit set freely and was ripe September 11. Size $1\frac{7}{16}$ inches across, $1\frac{3}{16}$ inches deep. Colour bright red almost all over; very pretty; flesh crisp, juicy, acid and of fair flavour; astringency very slight. When baked this fruit is acid, but of good flavour. Stems long, calyx persistent.

'*Progress.*—A cross of Wealthy male on *Pyrus baccata* female. The tree is a vigorous grower and fairly upright in habit. It blossomed freely; the blossoms were deep pink in bud, pinkish white when open, flowers large, petals wide. Fruit ripe September 14. Size $1\frac{5}{16}$ inches across and $1\frac{3}{16}$ inches deep. Colour red, with some yellow and with a dark red cheek. Flesh very firm, crisp, sub-acid, juicy, astringency scarcely perceptible; of fair flavour. Stem long, calyx persistent.

'*Prairie Gem.*—A cross of Tetofsky male on *Pyrus baccata* female. This tree is a moderately vigorous grower, and rather spreading in habit. It was covered with blossoms, which were pink in bud, white when open, of medium size, with petals of medium width, and was covered with fruit from top to bottom. The fruit was ripe August 30. Size 1 inch across and 1 inch deep. Colour brilliant yellow and crimson. Flesh crisp, juicy, acid; flavour good, almost free from astringency; excellent for jelly. Deficient in size but promising for its earliness, quality and profuse bearing habit.

'All these varieties are remarkable for the persistent manner in which the fruit is attached to the tree. The stems are so firmly fastened that they re-

quire a considerable effort to detach them. The trees are all very strongly built with the branches bound to the trees with bands of woody fibre which are difficult to break. Root grafts were made of some of these varieties in the spring of 1898, chosen on account of their promising growth. A number of these were sent at that time to Brandon and Indian Head, and thirty-one specimens of twenty-two varieties survived the winter at Indian Head and had made fair growth by the close of the season in 1899. At Brandon seventy-four specimens of twenty-five varieties passed safely through the winter of 1898 and made fair growth in 1899. In both these collections the variety named Charles is represented, three trees of this apple survived at Brandon and two at Indian Head. A further supply of root grafts of promising sorts was sent last spring, and now that the fruit of the five varieties referred to has proven of value these will be propagated more freely and arrangements are in progress for testing them in many different parts of the North-west country. There is every reason to expect that they will prove generally hardy and that they will be highly appreciated. It is not expected that these new fruits will be much esteemed where larger fruits can be grown, but if they can be grown without special care or protection by farmers generally throughout the North-west country and the colder sections of Ontario and Quebec where the larger sized apples do not succeed, they will prove a great boon to the settlers in those districts, and furnish a wholesome and healthful addition to the food of the people.

'Since five good sorts have been found among the first thirty-six of these crosses which have fruited, it is probable that many other equally good or possibly superior sorts will occur among the many cross-bred trees,—about 270 now growing at Ottawa—which have not yet fruited.

'Another series of crosses have been made on a species of *Pyrus* known as *Pyrus prunifolia* and its hardiness has been established by a test of several years on both of the North-west experimental farms. The natural fruit of this species is nearly double the size of of *P. baccata*. The first crosses in this line were made in 1896, and some of the trees from this source are now two years old and are strong and vigorous in growth. The varieties of the different crosses with *Pyrus prunifolia* number about 200 in all, among which there will no doubt be many interesting sorts.

'The results reported are but the first steps in a series of experiments which are full of promise. As the more useful of these hybrids bear fruit the seeds of the finest specimens are being sown from which we may expect many interesting sports. Now that the continuity of nature has been broken by the work of cross-fertilizing, the method of selection will be brought to bear on the best of the seedlings, from some of which increase in size and improvement in quality of fruit may be looked for, and within a few years we shall doubtless have from these sources a considerable number of useful sorts of apples ripening at different periods in the season which will endure the climate of all the settled parts of the North-west country.'

BUD-VARIETIES, SPORTS.

These are chance variations from the ordinary types which are sufficiently distinct to be regarded as different varieties. For instance, if the fruit on one branch of a tree which has not been grafted or budded is quite different from that on the others, it is a bud-variety. Bud-varieties may be propagated and perpetuated the same as other kinds.

PROPAGATION BY GRAFTING AND BUDDING.

When a good variety has been originated, more trees of it are usually wanted, and the process of increasing the number is called propagation. Plants which come true from seed, are, as a rule, increased by growing them from the seed; but as a variety of apple cannot be reproduced in that way, other methods must be adopted, and recourse is had to grafting and budding. There are other methods of propagation, but these are what are usually adopted in this country. In grafting the apple, the name scion is given to a cutting of wood of the variety that it is desired to propagate. The stock is the tree or portion of the tree, be it young or old, that the scion is to be, or is, united with. As it is only through the stock that the scion can procure the sap which nourishes it, at least for a time, the former must be furnished with roots.

Stocks.—Some kinds of fruits may be grafted successfully on others which are closely related to them botanically, such as the pear on the quince; but there is nothing so satisfactory to graft the apple on as the apple, and, under certain circumstances, the crab apple.

Although the stock and scions are united by the process called grafting, both of them retain, almost entirely, their individual characteristics. The stock does, however, modify the vigour and fruitfulness of the variety grafted on it. If a variety is grafted on a dwarf or slower growing tree than itself the result is that the stock tends to dwarf it, as a sufficient quantity of crude sap does not pass through it to maintain the natural vigour of the top; and as a lessening in vigour tends to the development of fruit buds, this kind of stock is often used for the purpose of inducing fruitfulness in a variety and for dwarfing the tree. The Paradise stock of Europe is an example of this kind of stock. There is, however, often such a difference in the growth of the stock and the variety grafted on it that the result is not satisfactory. It is quite possible that the stock may have the effect of making the tree hardier, as if growth is checked the wood may ripen better. In top-grafted trees, great care should be taken that the stock is a vigorous growing variety, as, if it is not, the union may be bad, or the top outgrow it and the tree will become top heavy and finally break down. While good results have been obtained by top-grafting on crab apple stock, it is not very satisfactory and should not be used unless in exceptional cases, as the union is often bad or the grafted part outgrows the scion.

Dwarf or slow-growing stocks are not recommended for use in any but the coldest parts of the country. The stocks used in root grafting and budding in the districts where the best apples can be raised successfully are usually obtained from apple seeds which are procured at cider mills or anywhere else where they can be got easily and in large quantities, and no pains are taken to learn what varieties produced the seeds. Stocks grown from this kind of seed, while quite satisfactory, as a rule, are not desirable in the coldest parts of the country where root-killing is liable to occur, as individual trees vary much in hardiness, and one might graft a hardy variety on a tender stock without knowing it. At Ottawa, what stocks are required for root-grafting are usually grown from seeds of the Martha crab, which is a very hardy, vigorous sort. Seeds from the hardiest varieties of both apples and crab apples are more likely to produce hardy stocks than if the seeds were obtained promiscuously.

For the very coldest parts of Canada where the apple can be grown at all, the berried crab, *Pyrus baccata*, will probably make the most satisfactory stock for root-grafting or budding. It is perfectly hardy at Indian Head, N.W.T., where the winters are very severe, having endured the climate there. The seeds from which the stocks are to be grown for root-grafting or budding should be treated in the manner already described under the heading 'Seedling Varieties.' It is important to cultivate the young trees thoroughly the first season if it is desired to use them for root-grafting during the following winter. Only the strongest should be used for this purpose, and the others left to grow for another season, when they may be used for budding, if propagation is done that way, or for root-grafting as before. They will not be large enough for budding the first season. If it is known that a hardy variety is growing on its own roots, hardy stocks may be obtained if pieces of the roots are cut off and scions grafted on them.

There are many of the best apples which will not succeed in certain parts of Ontario and Quebec when grown in the ordinary way, as they are either root-killed, or sunscalded so badly that they die from the effect of it. Experiments conducted at the Central Experimental Farm go to prove that by top-grafting these varieties on hardy stocks some will grow well and produce fruit of fine appearance and quality. To obtain these stocks it is necessary, first of all, to have hardy roots. This may be effected to a large extent by raising seedlings from the very hardiest apples or crab apples. A variety is then grafted or budded on them, which forms a straight, clean trunk which does not sunscald, and on this variety is top grafted the kind that does not succeed when grown in the ordinary way. The surest way, however, of obtaining hardy stocks is to grow the hardy varieties on their own roots as explained in the paragraph on Root-grafting.

SCIONS.

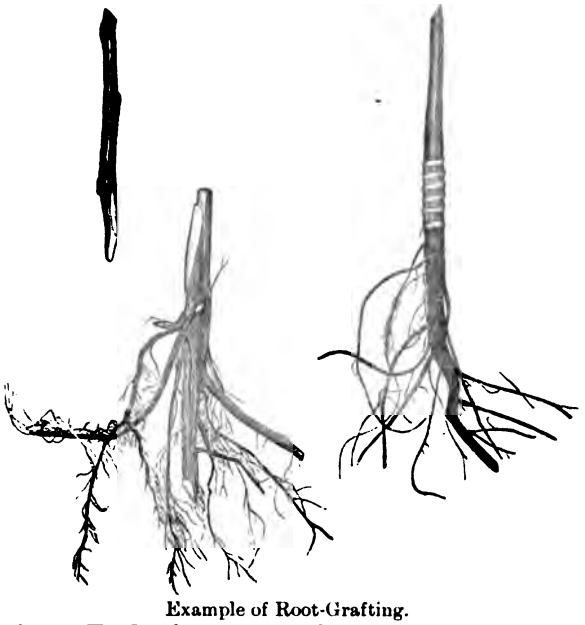
As much of the success in grafting depends on the condition and quality of the scions, too much stress cannot be laid on the importance of having them of the best quality and in the best condition at the time of grafting.

Scions may be cut any time after the wood is well ripened in the autumn and before the buds begins to swell in the spring. The best time, however, is in the autumn, as they may then be kept in the condition desired. If they are cut in cold weather, in winter, the trees from which they are taken may be injured if large numbers are removed from them, as the bark is liable to split, there is less sap also in the scions at that time and thus the chance of their drying up is greater than if they were cut in the autumn. One cannot tell very well, either, in winter whether the young wood has been injured or not. Scions should be cut from healthy, bearing trees. The wood of old trees is liable to be diseased, and if diseased wood is used it is likely to produce a diseased tree when grafted. Scions should also be cut from the most productive trees. Occasionally, one or more trees of a variety will produce more and heavier crops than the others. If scions are taken from these trees, the probability is that a larger proportion of the grafted trees will produce crops like the trees from which the scions were taken than they otherwise would. The scions should be cut from the wood of the current season's growth, as older wood is not satisfactory. The buds should be well developed and the wood thoroughly ripened. It is not wise to use the water sprouts or young shoots which spring from the main branches or trunk for this purpose.

They may not be thoroughly ripened, and it is also possible that sprouting propensities may be thus more developed in the grafted trees. The entire season's growth may be cut off and packed away until required for grafting, when it should be cut into pieces from four to six inches in length having three well developed buds.

Scions may be kept in good condition in moss, saw-dust, sand, or forest leaves. The last named are found very satisfactory at Ottawa. These materials should be slightly moist, but not wet; the object being to keep the scions fresh and plump without there being any danger of them rotting. They should be kept in a cool cellar which is not too dry, and should remain dormant until ready for use.

Root-Grafting. The cheapest and one of the best methods of propagating apples, especially in Canada, is by root-grafting. The strongest of the young stocks which have been grown in the manner already described are heeled in during the autumn in a cool cellar in moist sand. Grafting may be done any time during the winter, but it is usually not started until January or February. Whip or tongue grafting is the method usually employed. As only the root is required, the trunk and branches are cut off and thrown away. As there is but little advantage in using the whole root, it may be divided into several pieces, much depending on its size. Each piece should be at least four inches long. A smooth, sloping cut upwards, about two inches long, is made across the main part of the root most suitable to receive the scion. The scion is prepared by cutting off a piece of the wood procured for this purpose in the autumn from four to six inches long and with about three well developed buds on it; a smooth, sloping cut downwards and across it is now made of about the same length as that already made on the stock. Clefts are now made in the sloping surface of both scion and stock, in the former, upwards; and in the latter, downwards. They are then joined together by forcing the tongue of the scion into the cleft of the stock. The inner bark, or cambium, of both scion and stock should be in contact with one another on at least one side of the graft, as it is at this point of contact where the union begins to take place. In order to ensure a speedy and successful union, waxed cotton thread is wound tightly around to hold the parts together. Amateurs are also advised to rub grafting wax all over where the two parts are joined, as with this treatment success is likely to be more certain.



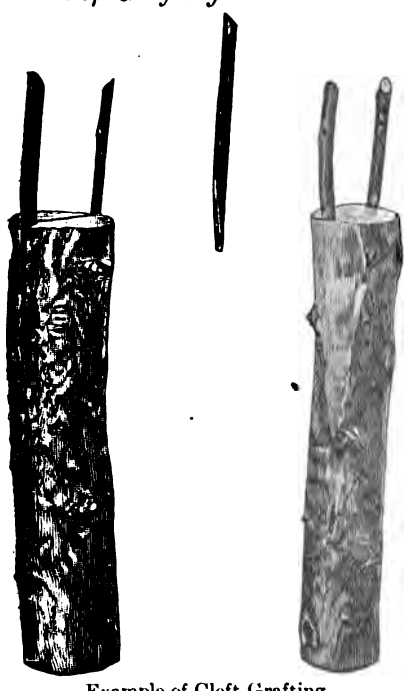
Example of Root-Grafting.

The operation having been completed, the grafts are packed away in moss or sawdust until spring. They are then planted out in nursery rows about

three feet apart and one foot apart in the rows, the point of union being about three inches below the surface of the soil. The ground should then be kept thoroughly cultivated throughout the season. Some varieties of apples throw out roots quite readily from the scion and after a time they thus become practically on their own roots. If it is desired to have a variety on its own roots, a scion from eight to twelve inches long may be used and the graft planted deep in the nursery row, only leaving one bud of the scion above the surface of the ground. Roots will then be thrown out on the scion, and when the tree is dug the stock may be cut away, and the tree will then be on its own roots. Or, on the other hand, a piece of root from a tree of the same variety as the scion may be used as the stock.

Crown-Grafting. Crown-grafting is usually done on young stocks in the nursery row in the spring. The trees are cut at or just beneath the surface of the soil at the crown or collar. A sloping cleft is then made in the side of the crown and a scion, cut wedge-shape at the lower end, is inserted in the cleft. The same precautions should be observed as in root-grafting, of having the inner bark of both stock and scion touching on at least one side. The grafted part should then be well covered with grafting wax, in order to exclude the air. The trees usually make a strong growth when grafted in this way, but as the work has to be done in April before growth begins it is often inconvenient to do it at that busy season of the year.

Top-Grafting. Where there are trees which produce poor or unprofitable fruit they may be made to bear good fruit by top-grafting other varieties upon them. If it is desired to grow a variety which, when grown in the ordinary way, proves a failure, on account of root-killing or sunscalding, it is possible to grow it successfully by top-grafting. Varieties which ordinarily take a long time to come into bearing will fruit much sooner when top-grafted. These are some of the most important results which may be obtained by this method.



Example of Cleft-Grafting.

Up to the present time in Canada, top-grafting has usually been done on old or bearing trees which produced poor fruit, and as very satisfactory results have been obtained this practice will continue to be popular.

The work is done in the spring before growth begins, but it is possible to graft successfully even when the trees are coming into leaf, provided the scion is quite dormant, but the chances of success are much lessened if it is done late. As the shock to a large tree would be very great if all or nearly all of the branches on which the leaves develop were cut off the first season, from three to four years should be devoted to removing the top of the tree. If, however, a large number of scions are inserted, the top may be changed in less time, but, as a rule, it is not wise to do it in less than three years. Furthermore, a too severe pruning at one time will cause a large number of shoots to grow on the tree, and considerable labour will be involved in removing them

if many trees are grafted. Cleft-grafting is usually adopted in top-working trees, it being a simple and satisfactory method.

The branches to be grafted should not exceed an inch and a-half or two inches in diameter. If they are larger it is so long before the stub heals over that disease may set in. It is possible, however, to graft larger branches by putting in more scions, The top-grafting of a large tree should be done with a view to having the new top as symmetrical as possible, and great care should be taken in selecting the branches to be grafted upon. After the branch is sawn off it is cleft by means of a mallet and strong knife to the depth of an inch and a-half to two inches. It is held open to receive the scion by driving a wedge into it. Scions for use in top-grafting are cut from dormant wood which has been kept in good condition in the manner already described. They should have about three strong buds and be cut wedge-shape at the base, one side, however, being a little thicker than the other. Two scions are now inserted in the cleft of the stub, with the wide side of the wedge on the outside, and thrust down until the lowest bud is almost on a line with the edge of the stub. The inner bark of both scion and stub should meet at some point, so that the union will take place readily, and this is more easily effected if the scion is given a slightly outward slope when inserted. When the wedge has been withdrawn from the cleft the advantage of having the wedge-shaped end of the scion thicker on one side will be apparent, as it will be held much more tightly than if both sides were the same. If the scion is not a tight fit all along, there is something wrong in the way it has been cut or the stub has been cleft. The cut parts should now be covered with grafting wax to exclude the air and hold the scion in place. Cotton is also sometimes wrapped around the wax in order to more effectively hold the scion in place. If both of the scions grafted on a stub should grow, the weaker one should be removed after the other is well united and the surface of the stub at least partially healed over.

It is often desirable to top-graft young trees, and this may be done very readily. The main branches are cut back to within a short distance of the trunk, and the scions grafted on, either by cleft or whip grafting. The closer the grafted part is to the trunk, the better, as the tree will be stronger than if the union occurred further out on the limb, since the growth of graft and scion may not be equal. It is possible to cut off the whole top of the tree and graft successfully on the main trunk, when the tree is young, but unless one is sure that the union will be perfect and the top not outgrow the stock, it is better not to run the risk of losing the tree. Furthermore, if the whole top is cut off there will be such a growth the first season that the scions are liable to get broken off. In top-grafting a young tree that has been planted from three to five years, it is better to take two seasons to do the work, as the results will, as a rule, be more satisfactory.

It is necessary to examine the grafted trees during the summer and remove any young shoots from the stocks which are interfering with the scions. It is not wise, however, especially when the tree has been cut back severely for grafting, to remove all the shoots until the grafts have grown considerably and furnish a good leaf surface. In the chapter on stocks, reference was made to the top-grafting of tender varieties on hardy stocks, in order to make the former hardier. The trees should be double worked as described there, planted out in the orchard, and when large enough, which will be in two or three years, top-grafted with the tender sorts.

In 1896, trees of McMahon White, Gideon, Haas, and Hibernal apples were planted in the orchards at the Central Experimental Farm. These are

all very hardy, strong-growing varieties which do not sunscald at Ottawa and which are fine, straight-trunked trees. They were grafted on hardy roots. In 1898 the work of top-grafting these with varieties that are not perfectly hardy was begun, and up to the present time the following sorts have been grafted :—Baldwin, Belle de Boskoop, Benoni, Domine, Early Harvest, Esopus Spitzenburg, Fallawater, Keswick Codlin, King of Tompkins Co., Mother, Newtown Pippin, Northern Spy, Ontario, Rhode Island Greening, Rome Beauty, Sutton Beauty, Wagener, Winesap, and York Imperial. Few of these varieties can be grown successfully at Ottawa as standard trees. Top-grafted, they have already endured two winters and the terminal growth has not been injured. This work will be continued until all the best varieties of apples which are likely to grow here have been tested. The results of this experiment will be watched with much interest from year to year. To show the possibilities in this direction, it may be said that in 1891 a tree of Duchess and two trees of Wealthy were top-grafted with Northern Spy, which will not live at Ottawa when grown as a standard tree. All of these fruited in 1897. The grafts on Duchess produced fruit in 1897 and 1899, and those on Wealthy in 1897 and 1898. The wood of the Northern Spy appears quite hardy, and if the Duchess and Wealthy had been stronger growing stocks it is probable that good crops would have been produced for many years, but the Northern Spy is outgrowing the stocks and soon the trees will be so top heavy that they will likely break off in a severe storm. It is, then, not wise to top-graft a strong-growing variety on a weak-growing stock.

Young tree top-grafted on main stem.

Part of tree top-grafted.

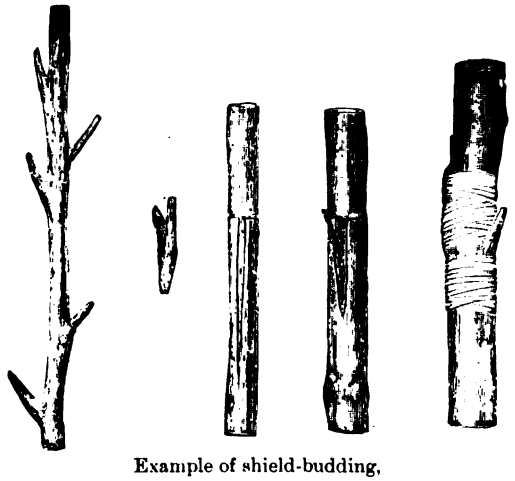
Budding. Although grafting is a much more common method of propagating apples than budding, the latter has some advantages over the former and can also be done at a time when grafting could not be performed successfully.

The best season for budding the apple is in late summer, some time during August being the best time for Ontario and Quebec. Young stocks of the second season's growth from seed are generally used. The process of budding adopted for apples consists in inserting a bud with very little or no wood, under the bark of the stock and on the surface of its wood. It is called shield-budding.

Budding is best performed when there is still sufficient sap beneath the bark to permit of the latter being easily raised with a knife. On the other hand, if the work is done when the tree is still growing vigorously the bud is liable to be 'drowned out,' or, in other words, forced out by reason of too much sap and growth of the stock.

The stock which is to receive the bud should be at least three-eighths of an inch in diameter near the ground. The lower leaves are rubbed off to a height of five or six inches to enable the budder to work more freely. A perpendicular cut is now made in the stock as near the ground as possible from an inch to an inch and a half long and preferably on the north side of the tree, as the bud will not be so readily dried out by the sun on that side. The cut should only extend through the bark. Another cut should now be made across the top of the perpendicular one. The two cuts when made will appear thus: T

The buds are cut from well developed and ripened shoots of the current season's growth of the variety it is desired to propagate. Before the buds are removed the leaves should be cut off the shoots; a piece of the petiole or leaf stem is left, however, by which the bud may be handled after it has been removed. A very sharp, thin-bladed knife is necessary in removing the bud. Knives are specially made for this purpose. The bud is cut off the shoot downwards or upwards, whichever is more convenient, the general practice, however, is to cut upwards. The length of the piece removed with the bud should be about one inch long, and the cut surface smooth. It should be quite thin, as but little of the wood is taken with the bud. The buds or twigs should be kept where they will not dry out while the work of budding is going on. The bud is inserted under the bark by raising the latter with the blade of the knife or the part of the budding knife made for that purpose. The bud is then pushed down and under the bark with the fingers, and finally the piece of leaf stalk which was left when it was removed from the twig is pressed with the blade of the knife to bring the bud into the proper position. The bark on each side of the bud, which should now be under the bark of the stock will hold it in position. In order to bring the bud and stock into close contact

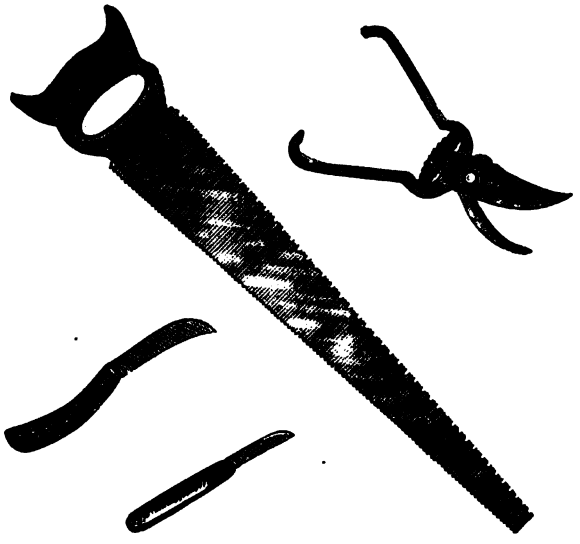


Example of shield-budding.

and prevent the former from drying up before the union takes place, they should be tied tightly together with raffia or some soft string, taking care not to cover the bud with it. The bud should unite with the stock in two or three weeks, and after that time the string should be cut, as otherwise the bud may be injured. If the proper season has been chosen for the work the bud should remain dormant until spring. If it starts in the autumn it may be killed during the winter. In the following spring the stock should be cut off just above the bud, which will cause all the strength of the stock to be directed into the bud and produce rapid growth, three feet not being an exceptional growth for the first season.

Budding is now a very popular method of propagating apples. The first season's growth is greater than from root-grafted trees and there is a larger proportion of straight trunked trees by this method. If it is desired also to prevent trees from becoming on their own roots, budding is preferable, as trees propagated in this way may be planted so that the stock is just at the surface of the soil and all roots are thrown from it

TOOLS AND APPLIANCES USED IN PRUNING AND GRAFTING.



Tools used by the fruit grower.

While grafting implements and appliances are numerous, the work can be done with a few, and as it is not often convenient for the farmer or fruit grower to get a large outfit, only the really necessary things are mentioned. These are:—A sharp, fine-toothed hand saw, to be used for sawing off large limbs, or for making the stubs on trees to be top-grafted where the limbs are too large to be cut with the pruning knife.

A strong pruning knife for cutting the smaller limbs; for smoothing the wounds made by the saw or pruning shears; for trimming off torn edges of branches, and for pruning roots of young trees when planting.

A budding knife, with a thin steel blade, for removing buds, having an ivory handle which is made thin at the end and is used for raising the bark.

A grafting knife, which is used in top-grafting trees. Home-made grafting knives can be easily made. A strong, sharp blade is the chief requisite.

Pruning shears, which are intermediate in their uses between the saw and the pruning knife. They are used for cutting off branches which are too large for the latter and too small to need the saw; for rough pruning and for cutting scions.

A wedge and mallet are also necessary in top-grafting large trees.

Raffia, which is one of the best tying materials. It is very strong and very pliable and is particularly useful for bandaging when budding.

Cotton yarn, which is used for tieing root grafts and is one of the most satisfactory materials for the purpose. The size known as No. 18 knitting cotton is the best. It is bought in balls, which should be soaked for a few minutes in melted grafting wax before using. The yarn may also be drawn through melted wax, which ensures its all being thoroughly soaked, and is, perhaps, on this account preferable to soaking the ball.

There are many kinds of grafting wax recommended, but it is unnecessary to enumerate them all. One of the cheapest and best is that recommended in *The Horticulturist's Rule Book*, under the name 'Reliable Wax,' the receipt of which is as follows:—

'Reliable Wax.—Resin, 4 parts, by weight; beeswax, 2 parts; tallow, 1 part. Melt together and pour into a pail of cold water. Then grease the hands and pull the wax until it is nearly white. One of the best waxes for either indoor or outdoor use.' This should be heated before using if too hard.

The principal value of grafting wax is to exclude air from the wound, and thus prevent the wood from drying before a union takes place. A good grafting wax should not crack when on the tree, else the air will reach the wound and the wax prove of little value. Many materials may be used instead of grafting wax for this purpose, one of the simplest being a mixture of clay and cow dung, but grafting wax is much to be preferred. Strips of cotton are often used, especially in top-grafting and crown-grafting, for wrapping around the wound after the wax has been applied for the purpose of helping to exclude the air, and also to assist in holding the scion in position until the union takes place. This cotton is unnecessary if good grafting wax is used; but if a very valuable variety is grafted it is safer to use the cotton, as when the growth of the scion is rapid there is a chance of its getting broken off during the first season before it is thoroughly united with the stock. Large wounds on trees should be covered with some material that will protect the cut surface from the weather, prevent disease from setting in, and which will not peel off easily. A good dressing of lead paint is probably the best material to use for this purpose. Grafting wax may be used on smaller branches.

THE NURSERY.

Although, as a rule, it will be the most convenient plan to buy trees from the professional nurseryman, yet he who propagates apple trees by root grafting, crown grafting, or budding, for his own use, should have a nursery in which to grow them until they are ready for the orchard. A good sandy loam soil, which does not bake and is well drained, is best suited for this purpose, and will grow the strong, healthy trees which are desired. The ground should be thoroughly prepared and the young trees planted about 12 inches apart, in rows from 2½ to 3 feet apart. Cultivation should be thorough up to about the middle of July, when it should cease, as in colder climates, especially, it is very desirable that the wood ripen well, and late cultivation would encourage late growth. It will be necessary the first year the grafted or budded trees are growing in the nursery to go over them carefully and cut out any shoots which may be coming from the stocks, and also to reduce the graft to one stem should more develop. If any side branches grow, however, they should be left intact. In small nurseries it is sometimes advisable to tie the young trees to stakes the first season. This will make them straighter and will help to keep them from being broken. These trees may be planted in the orchard

the following spring if one-year old trees are to be used. By the end of the second year or the beginning of the third, after the branches have been pruned to the proper height and the tops shaped, the trees will be in the best condition for planting in the orchard.

THE ORCHARD.

Site and Soil.—The farmer's orchard is, as a rule, near the house, and probably will be in the future, in most cases. There are many advantages in having it there which will offset the reason why it should not be. The man who makes fruit growing his main business, however, should consider well before deciding where he will plant his trees, so that good and profitable returns may be obtained. There has been much debate in recent years as to what slope is best suited for the apple. The trees planted on a southern or south-western slope are more subject to sunscald than if planted on a northern or eastern one. On the other hand it has been proven that in a very severe climate, trees suffer more from root killing on a northern slope, the intensity of the frost being greater. As sunscalding probably causes the death of more trees than root killing where the apple can be grown at all, and as root killing can be prevented to a large extent by growing cover crops, a northern or eastern slope would generally be best. It is not, however, necessary, to have the orchard on any slope, but sloping land is usually freer from early frosts and is better drained than level land, and good drainage is one of the chief essentials to successful apple growing. Good natural drainage is best, but if this cannot be had the soil should be thoroughly drained either with tiles or in some other way. Trees growing in badly drained soil will become stunted, diseased, short-lived and will rarely prove profitable.

The question of spring frosts should also be considered. All practical farmers and fruit-growers know that spring frosts are often very local, occurring on one part of a farm and not on the other. As these frosts sometimes mean much loss if they occur at the blossoming period, it is very important to avoid choosing a site where they are liable to do injury if another good site is available where frosts do not occur so often.

It is important, if possible, to have the orchard protected in some way from prevailing winds, and natural protection is an important factor in successful orcharding. The orchard can, however, be protected by planting windbreaks, reference to which is made elsewhere.

Apple trees grow well in almost any kind of soil if it is thoroughly drained. It is this adaptability of the apple which causes the trees to be planted frequently on poor land; but the better the soil, the better the results will be. A good orchard soil should, in the first place, be abundantly supplied with plant food in a form that may be made easily available. It should be rich in humus and should be easily worked, and if possible it should be of limestone formation. Sandy soil is easily worked, but is, as a rule, not rich in available plant food and is also lacking in humus. Plant food also which is applied in the form of barnyard manure and artificial fertilizers is easily leached away in sandy soil. In the colder parts of the country root-killing is also more prevalent in sandy soils. Clay land, on the other hand, is too stiff and is hard to work, the soil baking easily, and making it difficult to cultivate. Where, however, the ground is not kept cultivated and the fertility maintained by top dressing, trees are grown very successfully and good crops produced on this kind of land. The trees make less growth and on this account develop

more fruit buds than on light soils. Sandy loam and clay loam soils are, as a rule, the most suitable, and probably clay loam soils are the best for apple growing in the best apple-growing districts. Sandy loam soils are better further north, as they are warmer. Land which has been exhausted of much of its plant food by growing cereals or other crops upon it is less suitable for orchard purposes.

Preparation of the Land. It very often happens that the farmer or fruit grower suddenly decides to plant an orchard. No previous thought had been given to the matter, or if there had, nothing was done to get the land into better condition for the young trees. The trees are bought, the land hastily, and not very well, prepared and the trees set out to take their chances. No after cultivation will fully make up for neglect of the thorough preparation of the land. Trees should begin to grow thriftily from the time they are planted if they are to obtain a good size before they begin to bear heavily, and if the land is not thoroughly prepared and in good condition when they are planted, growth is likely to be slow. It is much better, if one has no land in good condition, to delay planting a year, and give the soil the necessary attention. The time will not be lost, as the trees will do much better. Land which has been well manured for root crops, ploughed in the autumn, and again ploughed in the spring and thoroughly levelled and pulverized with the harrow should be in good condition for planting the trees. If the subsoil is near the surface the subsoil plough should be used after the ordinary one, loosening the soil from four to six inches deeper than the former.

Sod land ploughed in the autumn, top dressed in the spring with a good coating of barn-yard manure and then ploughed again and thoroughly pulverized with the harrow, should also bring the soil into good condition. A green crop, such as clover ploughed under in the spring and the land thoroughly harrowed, would also be a very good method.

Time of Planting. Although trees may be planted successfully in the autumn, early spring is undoubtedly the best time. One of the few advantages of fall planting is that there is more time to do it then than in the spring. If trees are planted early in the autumn they will throw out some roots and be in a fair condition for standing the winter, but by the time the trees are ordered from the nurseryman and received, it is usually rather late, and if they are planted late the chances are that a large proportion will die, although this is not always the case. One cause of death appears to be that when the roots are not in close contact with the soil and the trees not well charged with sap, the trees dry out during the winter, and so die. It very often happens also that to begin with, the autumn is dry, and this makes the chances of success still less. It also often occurs, especially where the land has not been thoroughly prepared and only small holes dug for the trees, that rain, when it falls, does not escape from the holes. The water thus accumulated saturates the soil in the holes, freezes, and causes the trees to heave badly. If when this occurs it is overlooked and the trees not lowered in the spring, they may never thrive well. On the other hand, if trees are planted in the spring, the best conditions are afforded them for growing. They should, however, be planted in good season before growth begins and as soon after the ground is in condition to work as possible. As it is of the greatest importance to get the trees planted early and as, when ordered from nurserymen in the spring, it is difficult to get them as early as required, the best plan is to order them to be delivered in autumn and heel them in until spring, when they may be had as soon as required. A place should be chosen

or this purpose where the drainage is good, where there will not be danger rom mice, and where the trees will be well covered with snow. A trench hould be made deep enough to permit of the roots being well covered with oil. After cutting off any broken roots, the trees should be laid in a single layer n such a slanting position that the tops will almost touch the ground, and the oots and about half the trunk then well covered with soil, the latter being vell worked in among the roots. If treated in this way they should come hrough the winter in good condition.

Laying out the Orchard.—The distance apart that apple trees should be lanted will vary according to the varieties used, the locality, the land at the lanter's disposal, and the other purposes, if any, for which he intends to use he land. In order to thrive best and produce fruit of good size and colour, he trees should have abundance of sun, light and air, and they cannot obtain hese if planted too close together. Spraying has become such an integral art of successful fruit growing that sufficient space must be left between the rees to permit of doing this work thoroughly. When planted close, inurious insects and fungous diseases are more prevalent than where there is bundance of light and air. The only important advantage of close planting s the protection the trees afford each other, but it is only in the very coldest arts of the country where this protection is necessary, especially if low-headed rees are planted. The great mistake in the past has been that trees have een planted too close, the result being the production of poorly coloured, l-shaped, and scabby fruit.

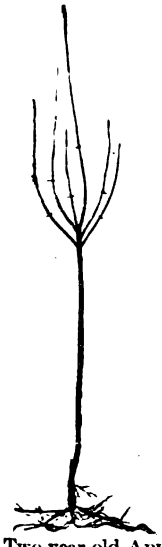
In the best apple growing districts most of the winter varieties should be lanted from 33 to 40 feet apart each way. This seems a great distance when he trees are young, but they will continue to bear profitable crops for many ears when trees planted much closer will have ceased to bear good fruit. A rowing practice now-a-days, and one which is giving good satisfaction, is to lant what are called 'fillers' between the permanent trees. These are early, eavy-bearing varieties, such as Wealthy, Duchess and Wagener, which begin o produce profitable crops of fruit when very young, and which may be emoved when they interfere with the permanent trees. Other fruits, uch as plums, cherries and peaches, may also be used for this purpose. f, however, the permanent trees are planted less than 40 feet apart ach way, the 'fillers' should only be planted between the trees in ne permanent rows, as in a few years the trees would be too crowded for est results, and spraying could not be thoroughly done. When the istance apart at which the trees are to be planted has been decided pon, the orchard should be laid out, or, in other words, the places narked where the trees are to be planted. The rows of trees should be erfectly straight, both for the sake of easier cultivation and appearance. his may be easily accomplished if a little trouble is taken. If the field is regular it is more difficult than if it is square. The places where the trees re to go should all be marked with stakes before the holes are dug, as it will e easier to keep the former in line if this is the case. The trees should be ghted both ways when placed in the holes.

Windbreaks.—If the orchard is not naturally protected from the wind by ees or by rising ground, a windbreak may be planted with good effect along ne north and west sides, or any other side from which the greatest injury omes, the object being not to stop the wind altogether, but simply to check its elocity, as if a windbreak is high and very dense it stops the circulation of r in the orchard to a large extent, and this gives very favourable conditions

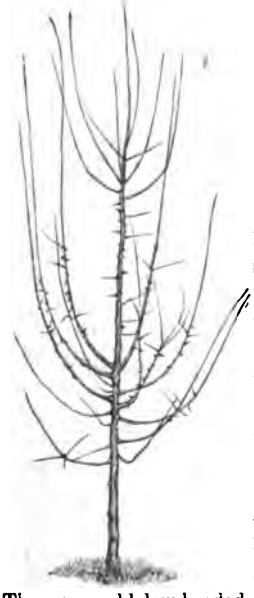
for the spread of both insect pests and plant diseases. On the other hand, a proper windbreak lessens the force of the wind and thus protects the trees, which will grow straighter and shapelier; it will also very materially lessen the amount of windfalls, and it will permit of growing varieties which will not succeed under ordinary exposure. Wind is one of the most important factors in drying out the land and causing drought. If its force is checked by a windbreak the evaporation of moisture from the soil will not be so great.

One of the best trees to plant for a windbreak is the Norway Spruce (*Picea excelsa*). It is a rapid growing evergreen and is hardy almost everywhere where apples can be grown successfully. A single row of these trees planted from eight to ten feet apart is quite sufficient. They should grow, if properly cared for, at the rate of from 2 to 3 feet a year until they reach a height of 50 to 60 feet. In very exposed places it may be desirable to plant two rows of trees, the trees forming the second row being planted between 8 or 10 feet behind the trees in the first row. The first row may be composed of Arbor-vitæ, which are rather slow growing, and the row behind made of Norway Spruce, if desirable. White pine and European larch are rapid growing trees which may be used for this purpose. Scotch pine is inclined to be irregular in growth, and is, on this account, sometimes not satisfactory. If the trees already mentioned cannot be obtained there are other native trees which will give good satisfaction.

Kind of Trees to Plant :—In the past, the popular tree was one with a trunk from five to six, and even, at times, seven feet high. The reasons why such trees were desired being that they enabled the planter to grow other crops nearer them than he could have done if the tops had been lower; they also enabled him to drive under the branches when working the land. The result, however, of training trees with such high trunks is that the apples are much more difficult to pick and the expense of picking them greater. When the trees are young the trunks are exposed to the sun, and sunscald is much more prevalent than it would be if there were less bare trunk and the head nearer the ground. These high headed trees are, however, gradually giving place to ones with less trunk, and from three to four feet is now considered the proper length by most of the best fruit growers. If trees of this kind are grown, the fruit can be much more easily picked, there is less trunk exposed to the sun, and the trees are stronger. There is also a less proportion of windfalls than from high headed trees, and it has also been found that proper cultivation can be given them at this height. If other crops are grown in the orchard they should take second place and trees should not be trained high on that account.



Two year old Apple Tree, marked for pruning.



Three year old low-headed Apple Tree.

In the colder parts of the country the best results will be had by starting the top within one to two feet from the ground, as the trees will be much

better protected than if the branches started higher up. It is possible that orchard culture, even in the best apple growing districts may be so modified in the future that it will be found that the best results will be obtained from trees branching out almost from the ground.

Two or three year old trees are, as a rule, the most satisfactory kind to plant, as when they are older than three years, growth is so checked and the trees so stunted by transplanting that it is not at all desirable to plant them when they are so old. Furthermore, the freight or express will be less on smaller trees. If low headed trees are desired they may be planted when one year old, if the growth is strong, and cut back to the desired height, leaving only the bare stem. The ordinary farmer, however, who may not give his trees much attention, requires a tree two or three years old, so that it may easily be seen if he grows other crops in the orchard. Trees should be procured from reliable nurserymen, as it is important to have them true to name and well shaped. A local nurseryman is best if he carries good stock. It will pay to get the highest grade of trees offered. Stunted, unshapely trees will never give the same results as healthy straight ones.

The two or three year old trees should have the heads well formed when received from the nurseryman. The best head consists of a central leader with three or four side branches rising alternately from the trunk. If the branches are opposite, a crotch is formed and when the tree is heavily laden a branch may be easily broken. It is not always possible to get a central leader, and the next best top is one with from three to five branches rising alternately from the main trunk, forming a symmetrical head.

Planting:—As many of the roots of apple trees are destroyed when they are dug, this should be taken into consideration when planting the tree, and the top headed in. If the top is not headed in there will not be enough sap from the roots which are left to support it, and the moisture transpired by the leaves being greater than the quantity supplied by the roots, the tree is liable to wither up and die. If the trees are grown by the person who plants them, great care should be taken in digging to destroy as few roots as possible. The amount of heading in will depend upon the number of roots and the condition of the tree. The branches should be cut back at least one-half and in the majority of cases it will pay to cut them back to about four buds. The work of heading in can be best done immediately after the trees are planted, as one can see better then what to do.

The "Stringfellow" method of planting trees has of late years been advocated by H. W. Stringfellow, of Texas. The theory of this method is that trees when transplanted in the ordinary way lose their tap root, but if the roots are pruned back to a mere stub a new tap root will be formed and the tree will be more permanent than when treated in the ordinary way. Trees pruned in this way would also be easier and more cheaply shipped, and make less labour in planting. To counterbalance the cutting off of the roots nothing is left of the top of the tree but a mere stub about eighteen inches long. While trees planted by this method may succeed under moist conditions of soil and climate, it is not a practice to be adopted in Canada where the soil and air are dry.

The roots of the trees should not be allowed to become dry from the time they are dug in the nursery or received from the nurseryman until they are planted. Much of the failure in planting comes through carelessness in this regard. When taking the trees to the orchard it is a wise precaution, especi-

ally if there are drying winds blowing, to puddle the roots in a thin mixture of loam and water, which will prevent, in a large measure, the small fibres from drying out. In addition to this, the roots should be protected until the trees are planted, by covering them with wet sacking or straw. Too much precaution cannot be taken in this matter. Before exposing the roots of the trees, however, the holes should be made. Many planters seem to have the idea that if they dig a hole barely large enough for the roots to be crowded into they will have good results. Sometimes they do; much oftener they do not. If the whole field has been subsoiled and is in a thorough state of tillage it would not matter so much, as the soil all over would be in the same state of friability, but this is very rarely the case. So that, as a rule, it is necessary to make the hole somewhat larger than will accommodate the roots, spread out to their full extent. It should be made about 18 inches deep, after which the subsoil should be loosened a few inches more, but not removed. In digging the hole, the surface soil should be kept separate from the subsoil or that of poorer quality. Sufficient surface soil should now be thrown back in the hole to make the tree, when planted, about an inch deeper in the ground than it was before. If a tree is not planted deep enough, the roots may become exposed and the tree die. On the other hand, it should not be planted too deep. Before it is planted permanently in the hole, the soil which has been thrown in should be raised and rounded off in the centre. If this is done, the roots of the tree can be spread out much more readily and placed more in their natural position. Roots of apple trees have not many fibres and it is necessary to spread what are left on the tree, carefully, in order to get the best results. Broken or bruised roots should be cut off before planting the tree.

The tree being now placed upright in the hole and the roots carefully spread out, the surface soil is gently thrown in and worked in among them, by the hand, if necessary. It is very important to have the soil come in close contact with the root fibres, in order that the best conditions may be afforded the tree to begin growth promptly. When the roots are well covered, more good soil should be thrown in and when the hole is about half full it should be well tramped with the feet, after which the hole should be filled level with the surface of the soil, tramping being done while it is being filled. The surface of the soil should be left loose, as this will help to prevent evaporation of moisture from the soil which has been thrown in. It is not necessary to water any tree if planting is done at the proper season and the soil fairly moist and well compacted about the roots.

If the orchard is in an exposed position and the trees large and with high trunks, it will pay to tie stakes to them to keep them from getting loose.

In districts where drought is liable to occur, or even in places where the soil is likely to become rather dry, it will be wise to mulch the trees to a depth of from 4 to 6 inches with manure, straw, sawdust, or anything of that nature which will not become a compact mass. If this is placed about the base of the tree and left during the summer it will keep the surface soil loose and prevent evaporation of moisture and the growth of the tree will be much more rapid. A good mulch may be the means of preventing a tree from dying if the season is very unfavourable or the tree in poor condition. If the mulch is loose when winter sets in there may be danger from mice, and this should be guarded against.

VARIETIES.

The selection of varieties for planting is a very important factor in successful apple culture. There are now probably over 2,500 named kinds of apples. In 1892 it was found that 878 varieties were advertised by nurserymen in America alone.

Downing, in his great work, describes 1,856 kinds. At the Central Experimental Farm 645 varieties have been grown since 1887, while at the Experimental Farm at Agassiz, B.C., 1,217 have been tested. It will be seen, therefore, that the number of sorts from which to select is very large indeed. Of these there are a limited number of varieties which excel all the others in merit, and yet a smaller number which can be recommended for growing in the provinces of Ontario and Quebec.

With the experience which has been obtained at the Central Experimental Farm, with the large number of varieties which have been tested there, and with the information which has been obtained from prominent fruit growers in Ontario and Quebec, it has been possible to come to a fairly accurate conclusion as to the kinds which will be most likely to give the best results in the various parts of those provinces.

Before selecting varieties to plant it is necessary, first of all, to decide on what will be done with the fruit when the trees come into bearing. If there are near markets, where the apples can be sold to advantage, more of the earlier and perishable kinds may be planted ; but if the markets are already overstocked with such fruit, as they are in most places, varieties which will ship well should occupy the predominant place. After the proportion of summer, autumn and winter varieties has been settled, it is necessary to know which kinds representing these seasons are hardy, and which are productive and of good quality and well coloured. The following list of varieties which has been made after careful study, and the descriptions of most of them which follow, are given in order to afford this information to intending planters.

The provinces of Ontario and Quebec have been divided into thirteen districts (see map) numbered from 1 to 13, representing roughly the various climates of the two provinces, and the varieties which have been thought most suitable for these districts, are given under their respective numbers. The lines dividing the districts are by no means arbitrary. It is impossible to fix a line on one side of which one variety will succeed, and on the other on which another will do well. The boundaries are merely suggestive. It will also frequently happen that there will be particularly unfavourable orchard sites in a milder district on which it would be wiser to plant the varieties recommended for a colder one. The judgment of the planter will have to be exercised in such cases. Many varieties will be found to occur in nearly all the lists. There are in summer and autumn kinds, particularly, quite a number which appear to do equally well in various climates. The object has been to keep the number of varieties recommended as small as possible. One great objection which British buyers make to apples from Canada is that too many kinds are shipped by one individual, and there is no large quantity of any one sort. The shipper suffers in such cases. The reason that so many varieties are grown is that up to comparativaly recent years it was not known which kinds would succeed best, but now more accurate information may be obtained, and if a few of the best kinds are planted there will be more profit.

A DISTRICT APPLE LIST FOR THE PROVINCES OF ONTARIO AND QUEBEC.

In the following lists of varieties recommended and suggested for th several districts marked off on the accompanying map, the summer an autumn kinds recommended are, as a rule, arranged in their order of matu ing. The early winter and winter varieties are mostly arranged in descendin order of merit from a profitable standpoint, but this arrangement is only su gestive. The order might be changed for different localities of the same di trict. Before planting an orchard, the owner should learn what varieties a proving most profitable in his vicinity.

The varieties which are merely suggested in these lists as worthy trial are arranged in somewhat the same order.

Information which was obtained from prominent fruit growers regardin the best varieties of apples in their districts has been freely used in th preparations of this list:

District 1.

Varieties recommended:—

Summer—Yellow Transparent, Red Astrachan, Duchess of Oldenburg.
Autumn—Gravenstein, Wealthy, Colvert, Twenty Ounce.
Early winter—Blenheim Pippin, Rhode Island Greening, Hubbardsto Nonsuch.
Winter—Ontario, Baldwin, Ben Davis, Cranberry Pippin, Fallawate Golden Russet.

Additional varieties suggested:—

Early winter—Ribston Pippin, Sutton Beauty.
Winter—Roxbury Russet, Rome Beauty, York Imperial.

Additional varieties suggested for home use:—

Winter—King of Tompkins Co., Northern Spy, Talman Sweet.

District 2.

Varieties recommended:—

Summer—Yellow Transparent, Red Astrachan, Duchess of Oldenburg.
Autumn—Gravenstein, Wealthy.
Early winter—Blenheim Pippin, Ribston Pippin, Rhode Island Greening
Winter—Ontario, Ben Davis, Cranberry Pippin, Baldwin, Golden Russet

Additional varieties suggested:—

Autumn—Fanny, Colvert, Fall Pippin, Twenty Ounce.
Early winter—Fameuse (a late autumn variety in this district) Sutton Beauty.
Winter—Rome Beauty, York Imperial, American Pippin, Salome.

Additional varieties suggested for home use:—

Summer—Primate.
Autumn—Maiden's Blush, St. Lawrence.
Early winter—McIntosh Red (really a late autumn variety in this district) King of Tompkins Co., Princess Louise, Grimes' Golden.
Winter - Esopus Spitzenburg, Talman Sweet.

District 3.

Varieties recommended : —
Summer—Yellow Transparent, Red Astrachan, Primate, Duchess of Oldenburg.
Autumn—Wealthy, Gravenstein (preferably top-grafted), Alexander.
Early winter—Fameuse, McIntosh Red, Blenheim Pippin (preferably top grafted), Ribston Pippin.
Winter—Ontario, Northern Spy, Westfield Seek-no-Further, Ben Davis, Stark, Golden Russet.
Additional varieties suggested :—
Winter—Gano, Salome, Scott's Winter.

District 4.

Varieties recommended :—
Summer—Yellow Transparent, Red Astrachan, Primate, Duchess of Oldenburg.
Autumn—Gravenstein, Wealthy, Colvert, Twenty Ounce.
Early winter—Blenheim Pippin, King of Tompkins Co., Ribston Pippin, Hubbardston Nonsuch, Rhode Island Greening.
Winter—Ontario, Northern Spy, Baldwin, Ben Davis, Stark, Golden Russet.
Additional varieties suggested :—
Early winter—Fameuse, McIntosh Red, Wolf River, Sutton Beauty.
Winter—Rome Beauty, York Imperial, Cranberry Pippin.
Additional varieties suggested for home use:—
Autumn—St. Lawrence, Keswick Codlin.
Winter—Swayzie Pomme Grise, Esopus Spitzenburg.

District 5.

Varieties recommended :—
Summer—Yellow Transparent, Primate, Duchess of Oldenburg.
Autumn—Trenton, Gravenstein, Wealthy.
Early winter - Fameuse, Blenheim Pippin, Hubbardston Nonsuch.
Winter—Ontario, Northern Spy, Ben Davis, Stark, Cranberry Pippin, Baldwin.
Additional varieties suggested :—
Autumn—Alexander, Colvert.
Early winter—King of Tompkins Co., Sutton Beauty, Rhode Island Greening.
Winter—York Imperial, Rome Beauty, Westfield Seek-no-Further, Roxbury Russet.

District 6.

Varieties recommended :—
Summer—Yellow Transparent, Red Astrachan, Duchess of Oldenburg.
Autumn—St. Lawrence, Wealthy, Alexander.
Early winter—Fameuse, McIntosh Red, Scarlet Pippin, Wolf River.
Winter—Ontario, Stark, Scott's Winter, Gano, Ben Davis, Golden Russet.

Additional varieties suggested :—
Winter—Pewaukee, Red Canada, Milwaukee, Salome.
Additional varieties suggested for home use :—
Early winter—Grimes' Golden.
Winter—Swayzie Pomme Grise, Yellow Bellflower, Northern Spy (top grafted).

District 7.

Varieties recommended :—
Summer—Yellow Transparent, Red Astrachan, Duchess of Oldenburg, Montreal Strawberry.
Autumn—St. Lawrence, Wealthy, Alexander.
Early winter—McIntosh Red, Fameuse, Scarlet Pippin, Shiawassee Beauty, Wolf River.
Winter—Scott's Winter, Gano, Red Canada, Salome, Golden Russet, Pewaukee, Ben Davis, Canada Baldwin.
Additional varieties suggested :—
Summer—Tetofsky, Switzer, Charlamoff, Brockville Beauty.
Autumn—Peach of Montreal, McMahon White, Haas, Flat Aport.
Early winter—Baxter, Winter St. Lawrence.
Winter—Arctic, Milwaukee, La Victoire, Lawver, Stark.
Additional varieties suggested for home use :—
Summer—Lowland Raspberry, Russell.
Winter—Swayzie Pomme Grise, Pomme Grise, Yellow Bellflower, Northern Spy (top grafted), Talman Sweet.

District 8.

Varieties recommended :—
Summer—Yellow Transparent, Duchess of Oldenburg, Red Astrachan, Montreal Strawberry.
Autumn—St. Lawrence, Wealthy, Alexander.
Early winter—Fameuse, McIntosh Red, Wolf River.
Winter—Scott's Winter, Gano, Red Canada, Golden Russet, Canada Baldwin, Ben Davis, Pewaukee, Salome.
Additional varieties suggested :—
Summer—Tetofsky, Switzer, Charlamoff.
Autumn—Peach of Montreal, McMahon White, Haas.
Early winter—Baxter, Winter St. Lawrence.
Winter—Arctic, La Victoire, Stark, Lawver.
Additional varieties suggested for home use :—
Summer—Lowland Raspberry.
Early Winter—Grimes' Golden, King of Tompkins Co. (top grafted), Princess Louise.
Winter—Northern Spy (top grafted), Swayzie Pomme Grise, Pomme Grise, Talman Sweet.

District 9.

Varieties recommended :—
Summer—Yellow Transparent, Red Astrachan, Duchess of Oldenburg, Montreal Strawberry.
Autumn—St. Lawrence, Wealthy. Alexander.

Early winter—Fameuse, McIntosh Red, Wolf River.
Winter—Canada Baldwin, Scott's Winter, Red Canada, Pewaukee, Golden Russet, Salome, Gano, Ben Davis.

Additional varieties suggested :—
Summer—Tetofsky, Early Williams, Charlamoff.
Autumn—Peach of Montreal.
Early winter—Winter St. Lawrence.
Winter—Arctic, Bethel, Arabskoe (Winter Arabka).

Additional varieties suggested for home use :—
Summer—Lowland Raspberry.
Winter—Swayzie Pomme Grise, Pomme Grise.

District 10.

Varieties recommended :—
Summer—Tetofsky, Yellow Transparent, Red Astrachan, Duchess of Oldenburg, Charlamoff. The two latter being really autumn varieties in this district.
Autumn—Peach of Montreal, St. Lawrence, Wealthy, Alexander, Haas. The last three being early winter varieties in this district.
Early winter—Wealthy, Fameuse, McIntosh Red, Wolf River (a winter variety in this district).
Winter—Scott's Winter, Golden Russet, Canada Baldwin.

Additional varieties suggested :—
Autumn—McMahon White, Hibernal, Longfield, Antonovka. All of these are early winter varieties in this district.
Winter—Milwaukee, Salome.

District 11.

Varieties recommended :—
Summer—Tetofsky, Yellow Transparent, Red Astrachan, Duchess of Oldenburg, Charlamoff. The last two being autumn varieties in this district.
Autumn—St. Lawrence, Alexander, Wealthy, Longfield. The last two being early winter sorts in this district.
Early Winter—Fameuse.
Winter—Scott's Winter, Golden Russet.

Additional varieties suggested :—
Autumn—Hibernal, McMahon White, Patten's Greening, Antonovka. These are all early winter apples in this district. Whitney Crab is also suggested.
Early Winter—McIntosh Red, Wolf River; the latter being a winter apple in this district.
Winter—Malinda, Milwaukee.

District 12.

Varieties recommended :—
Summer—Tetofsky, Yellow Transparent, Red Astrachan, Duchess of Oldenburg, Charlamoff. The two latter being autumn varieties in this district.
Autumn—Peach of Montreal, St. Lawrence, Wealthy, Alexander, Haas, Hibernal. The last four being early winter sorts in this district.

Early winter—Fameuse, McIntosh Red.
Winter—Scott's Winter, Golden Russet, Malinda.

Additional varieties suggested :—

Autumn—Antonovka, Longfield, Hibernal. Really early winter varieties in this district.
Early winter—Wolf River. A winter sort in this district.
Winter—Milwaukee.

District 18.

The most northerly district.

Varieties suggested :—

Summer—Tetofsky, Yellow Transparent, Duchess of Oldenburg, Charlamoff. The two latter being autumn varieties in this district.
Autumn—Whitney, Martha, and Transcendent crabs; also the hybrids between the Siberian crab and apple originated at the Central Experimental Farm; Wealthy, Hibernal, McMahon White, Longfield and Patten's Greening apples, all of which are early winter sorts in this district.
Early winter—McIntosh Red.
Winter—Scott's Winter, Malinda, Milwaukee, North-western Greening.

DESCRIPTION OF VARIETIES.

The following varieties have been practically all described by the author from typical specimens either grown at the Central Experimental Farm or received from fruit growers in the provinces of Ontario and Quebec. Nearly all the kinds recommended in the district lists will be found among them. They are divided into summer, autumn, early winter, and winter varieties and the names in each division are arranged alphabetically for ease of reference.

SUMMER VARIETIES.

Charlamoff (*Pointed Pipka, Arabka*).—A Russian variety, grown under several different names in this country, the most common being Pointed Pipka and Arabka. Fruit above medium to large, oblong, conical; skin pale yellow well splashed and streaked with bright purplish red or carmine; a few small white, fairly distinct dots; cavity deep, and of medium width; stem of medium length, stout; basin shallow and of medium width, wrinkled; calyx open; flesh white, rather coarse, juicy, mildly subacid, with a pleasant flavour; core small; quality good; season, August, just before Duchess; tree very hardy, a spreading, strong grower and heavy bearer. The chief fault of this variety is that it only remains in good condition for a very short time. It is a good dessert apple when at its best. Does very well at Ottawa and further north.

Duchess of Oldenburg (New Brunswicker).—Originated in Russia. Fruit medium to large, roundish to oblate; skin yellow, well splashed and streaked with bright red; cavity of medium depth and width; stem short, moderately stout or rather slender; basin deep, open; calyx partly open; flesh white, crisp, tender, juicy, acid. Quality only above medium as a dessert fruit, but one of the best cookers; season, August, but will keep until

September further north; tree very hardy, a moderate, spreading grower, and an early and very productive bearer. This variety was called the New Brunswicker in the Maritime Provinces some years ago, and it may still be found under that name there.

Red Astrachan.—According to Downing this was first imported into England from Sweden in 1816, and thence to America. Fruit medium to above medium in size, roundish, slightly conic; skin pale green, almost covered with bright and deep crimson, very handsome; dots few, pale, obscure; cavity deep and of medium width; stem of medium length, fairly stout; basin shallow and of medium width, slightly wrinkled; calyx open; flesh white, firm, crisp, juicy, almost acid, with an agreeable rich flavour; core small; quality good; season, latter part of July and first half of August; tree hardy and an upright, strong grower, but inclined to be a shy bearer.

Russell.—Originated in Russell Co., Ontario. Fruit medium to above medium in size, roundish to oblate; skin pale yellow, almost, or completely, covered with deep red; dots few, gray, not prominent; cavity shallow, open; stem long, slender; basin shallow, open, slightly wrinkled; calyx closed; flesh white, tender, melting, juicy, subacid, with a pleasant flavour, having a suggestion of Fameuse about it, slightly astringent; core large, quality good; season, middle of August to middle of September; tree vigorous. Top grafted on Wealthy at the Central Experimental Farm it has produced good crops every other year. It ripens unevenly, making it more desirable for home use than for commercial purposes.

Yellow Transparent.—Originated in Russia, and was introduced in America in 1870 by the Department of Agriculture, Washington. Fruit medium to above medium in size, roundish, slight conical, slightly angular; skin pale yellow; dots fairly numerous, pale and rather obscure; cavity deep, narrow; stem of medium length, fairly stout; basin narrow, shallow, slightly wrinkled; calyx closed; flesh white, firm, crisp, juicy, sprightly subacid, not high flavoured but pleasant; core small; quality good; season, latter part of July and first two weeks of August; tree an upright moderate grower, a good and early bearer and very hardy. The Yellow Transparent is the best apple of its season for the colder parts of Ontario and Quebec.

AUTUMN VARIETIES.

Alexander.—Of Russian origin. Fruit very large, roundish, conical; skin greenish yellow, well splashed and washed with deep red; dots few, obscure; cavity deep, and of medium width, russetted; stem short, moderately stout; basin deep, of medium width, almost smooth; calyx large, open. Flesh yellowish, rather coarse, moderately juicy, subacid, with a pleasant flavour; core medium size. Quality medium to above medium. Season late autumn. Tree hardy, vigorous, spreading and productive.

Fanny.—Originated near Strasburgh, Lancaster Co., Pa., U.S. Fruit above medium size, roundish to oblate, slightly conical; skin yellow, heavily splashed and washed with deep red; dots few, yellow and not prominent; cavity deep, moderately open; stem short, slender: basin of medium depth, narrow, almost smooth; calyx partly open. Flesh white, crisp, tender, juicy, subacid; core small; quality good. Season September. Tree vigorous, spreading, productive.

Gideon.—Originated by Peter M. Gideon, Excelsior, Minn., U. S. Fruit above medium size to large, roundish conical, ribbed; skin yellow with a bright rosy red blush; dots fairly numerous, yellow, distinct; cavity narrow, medium depth; stem short to medium, slender; basin shallow and of medium width, wrinkled, calyx closed; flesh white, crisp, juicy, brisk subacid, liable to water-core; core large; quality above medium; season October and early November; tree very hardy, a strong grower and moderately productive.

Gravenstein.—Originated in Germany. Fruit large to very large, roundish; skin yellow, splashed and streaked with orange and red; stem short, stout; basin wide and rather deep. Flesh tender, crisp, juicy, subacid and very high flavoured; quality very good; season September and October. Tree a strong, spreading grower and very productive.

Haas (*Fall Queen*).—Originated near St. Louis, Mo. Fruit medium to above medium in size; oblate; skin yellow, well splashed and washed with deep, sometimes brownish red: cavity deep; moderately open; stem short, stout; basin narrow, of medium depth, almost smooth. Flesh white, juicy, subacid, with little characteristic flavour, rather astringent; core small; quality medium to above medium. Season autumn. Tree hardy, a strong, upright grower and a good annual bearer. Not desirable except in the coldest parts of the apple growing districts.

Hibernal (*Romna*).—Originated in Russia. Fruit above medium to large, oblate conical; skin pale greenish yellow, splashed and streaked on sunny side with bright purplish red; a few white dots; cavity deep, of medium width, russetted; stem short, stout; basin of medium depth and width, slightly wrinkled: calyx open. Flesh yellowish, crisp, tender, juicy, acid; core small; quality above medium; season September to November. Tree very hardy, a strong, spreading grower, and very productive. Although not a good dessert fruit this is a fine cooking apple and on account of its great hardiness and productiveness is one of the best of the Russian apples.

Longfield.—A Russian variety introduced in the year 1870. Fruit sometimes medium, mostly below medium in size, roundish conical, slightly angular; skin pale yellow, almost white, with a bright pink blush; dots few, obscure; cavity very narrow, deep, more or less russetted; stem short, slender; basin narrow, of medium depth, wrinkled; calyx partly open; flesh white, crisp, very juicy, very tender, melting, brisk subacid, almost acid, pleasant; core medium; quality good; season October and November; tree very hardy, a moderate grower, spreading, pendulous, a very heavy bearer. Owing to the great crops, the fruit is liable to be undersized, and because of its tender flesh and pale skin, it shows bruises badly, which lessens its commercial value and is against it. It is a good apple for the north on account of its hardiness and low growth.

McMahon White.—Introduced by A. L. Hatch, Wis., U.S. Fruit large to very large, roundish, slightly conical; skin pale waxy yellow, almost white when in best condition, with a delicate pink blush; cavity deep, open, slightly russetted; stem short, stout; basin of medium depth, narrow, almost smooth; calyx open; flesh white, rather coarse, crisp, juicy, brisk subacid; quality above medium. An excellent cooking apple. Season October and November. Tree a very strong grower and a good cropper. Trees planted in the spring of 1888 are now bearing from 2½ to 3 barrels each. Owing to its vigour and apparent great hardiness it should be one of the best apples to plant near the limits of successful apple culture.

Twenty Ounce (Cayuga Red Streak).—Originated in Connecticut, U.S. Fruit large to very large, roundish; skin yellow, splashed and streaked with bright purplish red; cavity deep and wide; stem short and stout; basin of medium depth, calyx small, open; flesh white, coarse, juicy and briskly subacid; quality above medium, but a first-class cooking apple; season late autumn to early winter. Tree a strong grower and productive.

Wealthy.—Originated by Peter M. Gideon, Excelsior, Minn., U.S. Fruit of medium size, almost large on young trees, roundish; skin yellow, well splashed and washed and sometimes completely covered with crimson; dots yellow, fairly numerous, distinct, but not prominent; cavity deep and of medium width; stem short to medium, slender; basin narrow, rather deep, almost smooth; calyx partly open; flesh yellowish sometimes tinged with red, crisp, tender, juicy, briskly subacid with a pleasant aromatic flavour; core small; quality good to very good; season September to November, and later in some parts of the provinces; tree spreading, a medium grower and an early and heavy bearer. This is another apple which is hard to excel in its season.

EARLY WINTER VARIETIES.

Blenheim Pippin.—Originated at Woodstock, Oxfordshire, England. Fruit large, oblate; skin golden yellow, well washed and splashed with orange red mostly on the sunny side; dots few, pale, distinct but not prominent; cavity moderately deep, narrow, russetted; stem short, moderately stout; basin of medium depth, smooth, open; calyx large, open; flesh yellow, crisp, tender, melting, moderately juicy, mildly subacid, of good flavour; core small; quality good to very good. Season November and December. Tree a strong grower and a good bearer.

Fameuse (Snow).—Origin unknown. Supposed either to have been brought to Canada with the early French settlers or to have been a seedling originated in this country. Fruit of medium size, roundish to oblate; skin pale yellow, either almost or completely covered with deep red or splashed and washed with red when fruit is not well coloured; dots not prominent; cavity of medium depth and width; stem short to medium in length, slender or moderately stout; basin small, somewhat narrow, almost smooth; flesh very white, very tender, juicy, subacid with a fine flavour and a delicate perfume; core small; quality very good to best; season early winter; tree a strong grower, spreading, and a heavy bearer. This is one of the best dessert apples and one of the most profitable where it succeeds well.

Hubbardston Nonsuch.—Originated at Hubbardston, Mass., U.S. Fruit above medium to large, roundish to oblong, conical; skin yellow, splashed and washed with orange red and purplish red; dots fairly numerous, gray, distinct, but not prominent; cavity deep, narrow, russetted; stem short, slender; basin narrow of medium depth, slightly wrinkled; calyx open; flesh yellowish, crisp, very tender, melting, juicy, mildly subacid, with a pleasant flavour; core small; quality very good. Season early winter. Tree a strong, spreading grower and a good bearer.

King of Tompkins Co.—Origin uncertain; said to have originated in New Jersey. Fruit large, roundish, somewhat oblate, obscurely angular; skin yellow, well splashed and washed with bright crimson and orange red; dots fairly numerous, white, distinct, prominent; cavity of medium depth and width; stem short, moderately stout; basin of medium depth and width,

almost smooth; calyx closed; flesh yellow, rather coarse, crisp, tender, melting, moderately juicy with a rich, high, aromatic and very agreeable flavour; core small; quality very good to best; season early winter; tree a strong, spreading grower, but an uncertain cropper, the crops being usually light.

McIntosh Red.—Originated with John McIntosh, Dundela, Ont. Fruit above medium to large, roundish, slightly angular, highly perfumed; skin pale yellow, almost entirely covered with crimson, dark on sunny side and brighter on rest of fruit; dots few, small, yellow, distinct but not prominent; cavity of medium depth and width; stem short, stout; basin narrow, almost smooth, medium depth; calyx partly open; flesh white, crisp, very tender, melting, juicy, subacid, sprightly with a pleasant aromatic flavour; core of medium size; quality very good to best; season November to January; tree hardy, and a strong, moderately upright grower and an annual and medium bearer. For its season the McIntosh Red apple is one of the best varieties grown. It is said to be very subject to scab in some places, but this has not been the experience at the Central Experimental Farm. It has also not been found to be a shy bearer as reported by some.

Rhode Island Greening.—Originated on Rhode Island. Fruit large, oblate to roundish; skin green, often with a light, pink blush; dots numerous, pale or gray, distinct, but not very prominent; cavity narrow and of medium depth; stem short, moderately stout; basin narrow, shallow, slightly wrinkled; flesh yellow, crisp, tender, juicy, subacid, rich, slightly aromatic; core of medium size; quality very good. Season early winter to midwinter. Tree a spreading very strong grower and a heavy bearer. This variety is quite subject to scab and needs thorough spraying. It also lacks high colour, which is against it as an export apple.

Scarlet Pippin (*Leeds Beauty*).—Originated at Lyn, Leeds Co., Ontario, near Brockville. Mr. Harold Jones, Maitland, Ont., has had most to do in bringing this fine apple before the public. Fruit of medium size, oblate to roundish; skin yellow, waxy, more or less washed and splashed with bright and dark crimson, and covered with a light bloom; cavity deep and of medium width; stem short, slender; basin narrow, shallow, almost smooth; calyx generally closed; flesh white, firm, crisp, tender, melting, juicy, a mild subacid, with a pleasant but not high flavour; core small; quality very good; season early winter. A very attractive looking apple and said to sell better than Fameuse, which it does not, however, equal in quality. Tree a strong, upright grower, and said to be a heavy bearer.

Shiawassee Beauty.—Originated in Shiawassee Co., Mich., U.S. Probably a seedling of Fameuse. Fruit of medium size, oblate, flattened; skin yellow, well washed and splashed with deep crimson; dots few, pale, distinct; cavity deep, open; stem of medium length, slender; basin medium in depth and width, and almost smooth; calyx closed or open. Flesh white, crisp, tender, juicy, mildly subacid with a good flavour; core medium. Quality very good. Season early winter. Tree a hardy, strong, moderately upright grower, and a heavy bearer in alternate years.

Sutton Beauty.—Originated at Sutton, Mass., U.S. Fruit of medium size, roundish conic; skin waxen yellow, washed and splashed with crimson; dots fairly numerous, pale, distinct; cavity of medium depth, narrow; stem of medium length, moderately stout; basin medium in depth and width, slightly wrinkled; calyx of medium size, open or partly open; flesh dull white, crisp, firm, juicy, a sprightly subacid with a pleasant but not high flavour; core

small; quality good. Season midwinter. Tree an upright, strong grower and productive.

Winter St. Lawrence.—Imported in 1833 from Manchester, England, under the name of Mank's Codling, by the late Wm. Lunn, of Montreal. Named Winter St. Lawrence by the Montreal Horticultural Society about 1873. Fruit medium to large, roundish, slightly conical; skin greenish yellow well covered with deep red through which are dark purple splashes and streaks; dots fairly numerous, pale, distinct; cavity rather deep and medium in width; stem short, slender; basin narrow, almost smooth, of medium depth; calyx partly open, sometimes closed. Flesh white, rather soft, melting, moderately juicy, subacid, good flavour; core small; quality good; season, early winter. Tree a moderately spreading, strong grower and apparently very hardy. A shy but annual bearer at Ottawa.

Wolf River.—Originated with W. A. Springer, near Wolf River, Fremont, Wis., U.S., and disposed of to H. Riflen before coming into bearing. It is supposed to be a seedling of Alexander. Fruit large to very large, oblate conic, slightly angular; skin greenish yellow, becoming lighter later in the season, nearly covered with a dark red or crimson, with a few pale, distinct dots; cavity deep and of medium width, russetted; stem short, slender; basin narrow and of medium depth; calyx closed or open; flesh yellowish, moderately juicy, rather tender, subacid with a pleasant flavour; core of medium size; quality above medium; season, early to midwinter; tree hardy and a strong, spreading grower and a good cropper in alternate years.

WINTER VARIETIES.

American Golden Russet.—Origin uncertain. Fruit medium to above medium in size, roundish; skin greenish yellow, more or less russetted sometimes with bronzed blush; dots obscure; flesh greenish yellow, juicy, subacid with a high rich flavour; core medium; quality good to very good; season, late winter; tree a strong, upright grower sometimes but a light cropper. This is a valuable variety in the colder parts of Ontario and Quebec, as it is very hardy.

American Pippin.—Origin uncertain. Fruit medium to large, roundish; greenish yellow with a pink or orange blush or lightly splashed with same; dots fairly numerous, distinct but not prominent; cavity deep, medium in width, sometimes slightly russetted; stem short and stout; basin rather deep, medium in width and slightly wrinkled; calyx large, open; flesh yellow, firm, crisp, juicy, subacid; core small; quality good. Season late winter. Tree a vigorous spreading grower and productive. An exceptionally good keeping apple.

Baldwin.—Originated in Massachusetts, U.S. Fruit above medium to large, roundish; skin yellow, well washed and splashed with crimson and red; dots fairly numerous, gray, distinct; cavity of medium depth and width; stem short and stout; basin deep, open, somewhat wrinkled, calyx closed or open; flesh yellowish, firm, rather coarse, moderately juicy, mildly subacid, with a pleasant flavour; core small; quality good; season, late winter; tree moderately upright, vigorous and productive. Has been a very profitable variety in the past on account of its productiveness, appearance and good shipping qualities.

Ben Davis.—Originated in North Carolina early in the 19th century. Fruit medium to large, roundish conical; skin yellow, well splashed and

streaked with red; dots obscure; cavity deep, of medium width, slightly russetted; stem short, slender; basin of medium depth and width, wrinkled; calyx open; flesh dull white, firm, moderately juicy, mildly subacid, but has no characteristic flavour; core medium; quality medium; season late winter; tree hardy, spreading, vigorous and very productive.

Bethel.—Originated in Vermont. Fruit large, roundish, slightly angular; skin greenish yellow, splashed and streaked with carmine; dots numerous, greenish yellow, prominent; cavity deep, of medium width, slightly russetted; stem short, slender; basin shallow, narrow, smooth; calyx partly open; flesh whitish with traces of pink, juicy, mildly subacid; core of medium size; quality good; season, midwinter to late winter; tree a strong grower.

Canada Baldwin.—Said to have originated from seed of Pomme de Fer on the farm of Alexis Dery, St. Hilaire, Que. It was given its name by N. C. Fisk, Abbotsford, Que., who propagated it in 1855. Fruit of medium size, roundish to slightly oblate; skin yellow, well washed, splashed and streaked with bright red and crimson; dots fairly numerous, large, yellow, prominent; cavity deep, open; stem short to medium in length, slender; basin medium in depth and width, slightly wrinkled; caylx closed or partly open; flesh white, tinged with red almost to the core, rather coarse, firm, inclined to be corky, fairly juicy, mildly subacid, with a pleasant flavour, slightly astringent; core small; quality good; season midwinter; tree an upright, strong grower; a shy but annual bearer at Ottawa; said to be subject to sunscald, but trees have not suffered much from it here.

Cranberry Pippin.—Originated near Hudson, N.Y. Fruit large, roundish; skin yellow, splashed, streaked and washed, especially on the sunny side, with bright purplish red; dots fairly numerous, small, gray, not prominent; flesh white, crisp, moderately juicy, rather coarse, subacid, flavour not very marked; core small; quality medium; season, early winter to midwinter; tree a very strong, spreading grower and productive.

Esopus Spitzenburg.—Originated on the Hudson River. Fruit medium to above medium in size, oblong, tapering, angular; skin yellow, nearly covered with bright rich red which is darker on the sunny side; dots numerous, yellow, prominent; cavity deep and narrow; stem short, moderately stout; basin narrow, of medium depth, wrinkled; calyx of medium size, partly open; flesh yellow, crisp, tender, juicy, subacid with a rich high flavour; core of medium size; quality very good to best; season early to midwinter; tree a poor grower of moderately spreading habit and usually a light bearer, which lessens its value for commercial purposes, though one of the best for home use.

Fallawater.—Originated in Pennsylvania. Fruit large to very large, roundish; skin yellowish green washed with pink or dull red, mostly on the sunny side; dots few, pale, large and prominent on the red portion of skin; cavity narrow, of medium depth, slightly russetted; stem short, rather slender; basin narrow, of medium depth, slightly wrinkled; calyx partly or fully open; flesh greenish yellow, crisp, tender, juicy, mildly subacid, with a pleasant flavour; core small; quality good; season, midwinter to late winter; tree a strong grower and a good bearer.

Gano.—Originated in Missouri and is said to be a seedling of Ben Davis. Fruit above medium size, roundish conical; skin yellow, almost completely overspread with crimson, not splashed or streaked as Ben Davis; dots gray, obscure; cavity of medium depth and width; stem short; basin of medium

depth and width, slightly wrinkled; calyx open. Flesh dull white, somewhat tenderer than Ben Davis, moderately juicy, mildly subacid, has no characteristic flavour; core medium; quality medium; but little, if any, better than Ben Davis; season late winter. Tree a hardy, upright, strong grower and an annual and good bearer. This is a very handsome apple, being more highly coloured than Ben Davis, as grown at Ottawa.

La Victoire.—Originated near Grenville, Que. Probably a seedling of Fameuse. Fruit above medium size, oblate, regular; skin greenish yellow, almost covered with crimson; dots fairly numerous, gray, distinct; cavity of medium depth and width, slightly russetted; stem short and stout; basin of medium depth and width, almost smooth; calyx open and medium in size; flesh white, tinged with red, rather coarse, moderately juicy, mildly subacid, with a pleasant flavour; core small; quality good; season midwinter; tree hardy and a strong, moderately spreading grower. This variety has not, so far, proved very productive, but is a handsome apple, and on account of its season and hardiness will probably prove useful in the north.

Lawver (*Delaware Red Winter*).—Origin uncertain. Fruit above medium size, roundish to oblate, somewhat angular; skin yellow, nearly all, or quite, covered with bright to deep red; dots few, pale, distinct; cavity medium in depth, narrow; stem long and slender; basin very shallow, narrow, wrinkled; calyx small and closed; flesh yellow, faintly tinged with pink, firm, crisp, tender, juicy, sprightly subacid, slightly aromatic; core small; quality above medium; season late winter; tree, hardy, vigorous, moderately upright. An annual bearer but not a heavy cropper. This is an exceptionally good keeper. The fruit may be kept for a year in an ordinary cellar without difficulty.

Mann.—Originated in New York State. Fruit above medium to large, oblate; skin very green in early winter changing to yellow when fully ripe, often with a brownish pink blush; dots numerous, pale, and quite prominent in early winter; cavity deep, medium in width, russetted; stem short, slender; basin of medium depth and width, slightly wrinkled; calyx partly or fully open. Flesh yellow, crisp, juicy, mildly subacid, with a pleasant flavour. quality good; season late winter. Tree a vigorous, spreading grower and an early and heavy bearer. A good keeping apple but lacks attractive colour.

Milwaukee.—A seedling of Duchess which originated in Wisconsin. Fruit large, oblate, slightly angular; skin pale yellow well splashed and washed with bright red and crimson; dots few, small, white, not prominent; cavity deep and of medium width, slightly russetted; stem short, moderately stout; basin deep, open, slightly wrinkled; calyx open. Flesh yellowish, crisp, very tender, juicy, acid with but little characteristic flavour; core small. Quality above medium; season December to March. Tree spreading, a moderate grower and an early and good cropper. A promising apple for the north, as it appears to be very hardy.

Northern Spy.—Originated near Rochester, N.Y., U.S. Fruit large to very large, roundish conical, slighly angular; skin yellow, usually well washed, splashed and streaked with pinkish red, which in highly coloured specimens becomes bright red; there is also a pale bloom which increases the attractiveness of this variety; dots few, small, yellow; cavity deep, open; stem short, moderately stout; basin of medium depth, narrow, slightly wrinkled; calyx small, closed or open; flesh creamy white, crisp, tender, juicy, subacid, sprightly, aromatic, of a good flavour; core rather large; quality very good to best; season midwinter to late winter. Tree

an upright, strong grower and yields good crops in alternate years, when comes into bearing, but it is usually from twelve to fifteen years before fu crops are produced.

Ontario.—Originated by the late Charles Arnold, by crossing Wagen with Northern Spy. Fruit large to very large, oblate, sometimes roundis slightly angular; skin yellow, usually well washed and splashed with brigl red and carmine, there is also a pale pink bloom which adds to the appea ance of this variety; dots few, pale and a little larger and more distinct than c the Northern Spy; cavity deep, open, slightly russetted; stem short, moderate stout; basin medium to rather deep, slightly wrinkled; calyx small, open c closed; flesh creamy white, crisp, tender, juicy, a brisk subacid (more aci than Northern Spy), sprightly, slightly aromatic; core small; quality ve good; season midwinter to late winter. Tree moderately vigorous, but a early and heavy bearer. One of the best apples, both for commercial pu poses and for home use.

Red Canada.—Origin unknown. Fruit medium to large, oblate, slightl conical; skin yellow, well splashed and washed with deep, rather dull red dots fairly numerous, large, yellow, prominent; cavity deep, narrow; ste short, slender; basin narrow, shallow, slightly wrinkled; calyx small, partl open; flesh yellowish, tender, moderately juicy, mildly subacid with a pleasa but not high flavour; core of medium size; quality good; season midwint to late winter. Tree a strong grower and has proved productive in som places, while a shy bearer in others.

Roxbury Russet.—Originated in the State of Massachusetts and is thougl by many to be the same as the Nonpareil of Nova Scotia. Fruit above me ium to large, oblate, conic, slightly angular; skin greenish yellow, more c less russetted, sometimes with a bronze blush; dots obscure; cavity of me ium depth, open; stem short, stout; basin of medium depth and widtl smooth, calyx open or closed; flesh yellowish, tender, moderately juicy, subaci with a good, rich flavour; core small; quality very good; season midwint to late winter; tree moderately vigorous, spreading and a good cropper.

Salome.—Originated with Elias C. Hathaway, Ottawa, Ill., U.S. Fru medium to below medium in size, roundish conical, somewhat angular an inclined to be irregular; skin pale yellow, splashed and washed with bright ar sometimes rather pale red, overspread with a delicate pink bloom making tl fruit very attractive looking; dots numerous, pale yellow, prominent; cavi deep and medium in width; stem short, moderately stout; basin narro medium in depth, almost smooth; calyx small, closed or partly open; fle yellow, crisp, tender, moderately juicy, subacid, slightly aromatic; core larg quality good; season midwinter to late winter; tree a strong, upright growe hardy and a good cropper. When the crop is large the fruit is liable to ru below medium in size. This is a handsome apple and being hardy and a go keeper is valuable in the colder parts of the country.

Scott's Winter.—Introduced by Dr. F. H. Hoskins, Newport, Vt., U. Fruit medium to below medium in size, roundish conical, angular; skin y low, well splashed and washed with deep orange and purplish red; d obscure; cavity of medium depth and width, slightly russetted at base; st short, moderately stout; basin deep, rather narrow, slightly wrinkled; cal partly open; flesh yellowish, crisp, tender, juicy, acid but with a pleasant flavo core medium; quality above medium, almost good; season late winter. Tr very hardy and a strong, upright grower. An annual bearer and a gc cropper.

Stark.—Origin not known. Fruit large, roundish, slightly angular; skin greenish yellow when in good condition, more or less splashed and washed with brownish pink, mostly on the sunny side; dots not prominent; cavity of medium depth and width; stem short, moderately stout; basin of medium width, rather shallow; calyx large, partly open or open; flesh yellow, moderately juicy, rather coarse, mild subacid, pleasant but not high flavoured; core medium; quality almost good; season late winter. Tree a strong, moderately spreading grower. This has proved a light cropper at the Central Experimental Farm, but is reported to be a good bearer elsewhere. The trees here, however, have only been planted since 1891.

Swayzie Pomme Grise.—Supposed to have originated near Niagara, Ont. Fruit below medium, sometimes almost medium in size, oblate to roundish; skin yellow covered with a thin russet nearly all over; dots fairly numerous, pale, distinct but not prominent; cavity deep, narrow; stem short, slender; basin narrow, of medium depth, almost smooth; calyx partly open; flesh pale greenish yellow, crisp, breaking, tender, juicy, sprightly subacid with a high aromatic flavour; core small; quality very good to best; season midwinter; tree hardy and an upright but only moderate grower and rather light cropper. A fine dessert apple.

Talman Sweet.—Originated on Rhode Island. Fruit medium to above medium in size, roundish; skin yellow when fully matured with often a faint blush on the sunny side; a distinct line usually runs from stem to calyx; dots few, gray, not prominent; cavity open, medium in depth; stem rather long, slender; basin medium in depth and width, wrinkled; calyx open; flesh white, firm, moderately juicy, sweet, with a high flavour; core small; quality very good for a sweet apple; season early winter to late winter. Tree a strong, spreading grower and very productive.

Wagener.—Originated in the State of New York. Fruit medium to above medium in size, oblate; skin yellow, well washed and streaked with crimson; dots pale, distinct; cavity wide, deep; stem medium length, slender; basin medium in depth, wrinkled; flesh yellowish, crisp, very tender, juicy, briskly subacid, pleasant flavour; quality very good to best; season midwinter. Tree an upright and moderate grower and an early and heavy bearer.

Westfield Seek-no-Further.—Origin, Connecticut, U.S. Fruit of medium size, roundish conical; skin yellow, well washed and splashed with deep red; dots numerous, large, yellow, distinct, prominent; cavity deep, narrow, russetted; stem short, moderately stout; basin narrow, shallow, smooth; calyx open; flesh yellow, tender, melting, juicy, mild subacid, with a pleasant flavour; core above medium in size; quality very good; season midwinter. Tree vigorous and productive.

Yellow Bellflower.—Originated in Burlington, N.J., U.S. Fruit large, oblong conical; skin pale yellow, often with a pinkish or orange blush on the sunny side; dots few, gray, prominent; cavity of medium depth and width; stem of medium length, moderately stout; basin narrow, shallow to medium, wrinkled; calyx closed or partly open; flesh yellow, tender, buttery, juicy, subacid, with a pleasant flavour; core large; quality good; season midwinter. Tree a spreading, moderate grower, and productive.

York Imperial.—Supposed to have originated in York Co., Pa., U.S. Fruit of medium size, oblate, flattened and somewhat one sided, angular; skin yellow, splashed and washed with bright red; dots few, yellow, distinct,

but not prominent; flesh yellowish, firm, crisp, tender, moderately juicy, mildly subacid with but a slight characteristic flavour; quality above medium; season late winter. Tree a moderate grower, but productive. A very popular commercial apple in some parts of the United States.

RUSSIAN APPLES.

When the Russian apples were first introduced into Canada it was thought that they would prove a great acquisition, especially in those parts where the climate was severe. Most of the varieties, of which a large number were imported, have proved to be of inferior quality, and as almost all of them are early apples, their usefulness has been necessarily limited. There are, however, a few of them which are very valuable, and, being hardier than most varieties of American origin, are useful to those who live near the extreme limits of successful apple culture. As far north as Ottawa, however, which is about latitude 45°, many apples of American origin succeed well, and these are, in most cases, preferable to the Russian. North of latitude 45° the Russian apples increase in value the further north they are grown. The Yellow Transparent and Duchess of Oldenburg apples are exceptions to almost all the others, these being standard varieties in all parts of Canada where apple trees are grown.

A large number of Russian apples have now been tested for twelve years at the Central Experimental Farm. In the year 1888 there were planted in the orchards 133 supposed varieties. Since that time others have been added at intervals, and, notwithstanding those which have been winter-killed, there are now about 160 varieties, though some of these may be synonyms, as a number of synonyms have already been discovered.

A few of the trees planted in 1888 fruited in 1890. The trees did well and made vigorous growth up to the year 1892, when blight appeared in the orchard and did considerable injury, and in 1893 the disease appeared earlier in the season and committed great ravages among the trees. This left the orchard in a very bad condition. Some trees had died altogether, others were reduced to stumps, and again others which had large diseased limbs sawn off had lost their symmetry. The trees were not so much affected in 1894 and 1895, but owing to the severity of the winter of 1895–6 a large number were root-killed. Further injury from root killing occurred during the winter 1896–7. During the past three seasons the trees have been replaced and have made good growth, and many of those which were affected by blight are regaining symmetrical proportions.

The most promising varieties are recommended in the district lists and described elsewhere in this bulletin.

The following case for and against the Russian apples, which was published by Prof. F. A. Waugh, in Bulletin No. 61, of the Vermont Agricultural Experiment Station, so fully expresses our own opinion of them that it is endorsed, and herewith quoted :—

FOR.

'They have given us several varieties of recognized value, like Olden burg and Yellow Transparent.

'They promise to give us other useful varieties through gradual inter crossing with our common apples.

'They furnish hardy trunks on which more tender varieties may be grafted to advantage.

'The trees are very hardy.

'They are mostly free from disease (except blight).

'They usually bear early and abundantly.

'The fruit is often large and finely coloured.

'Their introduction has encouraged many persons to grow apples in regions where they would not otherwise have attempted it.

AGAINST.

'Very many of the varieties introduced are immensely worthless.

'Most of them ripen too early and will not keep. This is due to their introduction from a zone of shorter season to one of longer seasons.

'The fruit of many varieties drops badly before mature.

'The fruit is usually coarse grained and of poor quality.

'The skin is often very thin and tender, making the fruit liable to injury.

'Their nomenclature is so badly confused that no one can be sure of what he is handling.

'The young growth is extremely subject to "fire blight."

POLLINATION OF APPLES.

It is now known that the cause of the unproductiveness of some varieties of apples when planted in large blocks by themselves is often due to either complete or partial self-sterility of the blossoms. It has also been found that varieties self-sterile in themselves will, if planted near each other, be cross-fertilized, if the two varieties bloom at the same time, and fruit will set on both kinds As it has been found that a variety which is self-sterile in one locality is not necessarily so in another, it is impossible to give an accurate or complete list of those which are self-sterile and those which fertilize themselves. The relative blossoming periods of the different varieties of apples, however, are fairly regular in the provinces of Ontario and Quebec, and by planting those kinds which bloom about the same time it is not absolutely necessary to know whether a variety is self-sterile or not. For five years, observations on the dates of blossoming of varieties of apples were made by persons in various parts of Canada for the Horticultural Division of the Central Experimental Farm. The data thus accumulated have been compiled and it is now possible to give the following list of apples divided into three groups, according to their average time of blooming. While this division may not hold good in all parts of Canada, it will be found to be fairly correct in the whole.

EARLY GROUP.

Antonovka, Duchess of Oldenburg, Early Harvest, Fameuse, Gravenstein, Gideon, Haas, Hurlbut, Longfield, Patten's Greening, Red Astrachan, Scott's Winter, Shiawassee Beauty, Tetofsky, Wagener, Scarlet Pippin—16 varieties.

MEDIUM GROUP.

Alexander, Baldwin, Baxter, Ben Davis, Blenheim Pippin, Canada Baldwin, Esopus Spitzenburg, Fallawater, Fall Jenetting, Gano, Golden

Russet (American), Hubbardston Nonsuch, Jonathan, Keswick Codlin, King of Tompkins Co., McIntosh Red, McMahon White, Magog Red Streak, Maiden's Blush, Malinda, Mann, Newtown Pippin, Peach, Pewaukee, Pomme Grise, Primate, Princess Louise, Rhode Island Greening, Roxbury Russet, St. Lawrence, Salome, Stark, Swaar, Swayzie Pomme Grise, Wealthy, Winter St. Lawrence, Wolf River, Yellow Transparent, Ontario, Ribston Pippin, Colvert, Brockville Beauty—42 varieties.

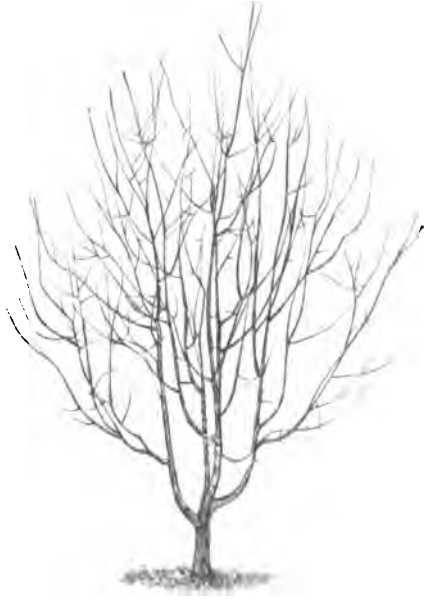
LATE GROUP.

Blue Pearmain, Cranberry Pippin, Grimes' Golden, Lawver, Northern Spy, Red Canada, Talman Sweet, Walbridge, Westfield Seek-no-Further, Yellow Bellflower—10 varieties.

PRUNING.

There are several objects in pruning trees, the principal being the production of well coloured fruit of good size, in paying quantities, and the maintaining of a symmetrical top and well balanced tree to bear this fruit. Trees will bear fruit without pruning, but it is small in size and not so attractive. Unpruned trees, also, are likely to bear heavily one year and have no crop the next. Pruning lessens the number of apples produced and the tree not being so much exhausted at one time is likely to bear more regularly. It does not exhaust a tree as much to bear a good crop of fine fruit as it does to produce a heavy crop of small fruit, as the exhaustion of the tree is in proportion to the number of seeds matured, and not to the size of the fruit.

Low headed apple tree unpruned.



Low headed apple tree pruned.

Trees should be pruned regularly, beginning when they are young. If much pruning is done at one time it would be likely to injure the tree.

When the trees begin to grow thriftily many new branches will be formed, and it is the work of the pruner to remove all those which are not necessary and to cut back others. The top of the tree should be kept open, to admit air and sunlight, but pruning should be so carefully done that there will be no bare limbs. All branches which are growing across and through the top should be cut out. If two branches touch one another, one of them should be removed. If a branch on one side of the tree has outgrown the other, it should be headed back so as to make the tree symmetrical, cutting it off just above a bud which is on the side that it is desired to have the new growth. If, when the trees are young, they are treated in this way every year, comparatively little work will have to be done at one time. The best time to prune is between the middle of May and the middle of June when the trees are growing thriftily, as the wounds will heal over quicker if done at that time, but as this is a very busy season of the year the customary practice is to prune during the month of March, when quite satisfactory results are obtained. By pinching off young growth, which is not required, in summer, labour will be saved in pruning. It is much better to prune at any time of the year than to neglect it altogether, as it is not a matter of great consequence what month it is done in. The tools used should be a sharp pruning knife and a fine saw; the branch should be cut off close to the limb or trunk from which it is removed and the cut should be as clean and smooth as possible. A bad practice in pruning, and a very common one, is to leave the stub remaining of the branch cut off. In many cases this never grows over, rot sets in and reaches the heart of the tree, and eventually ruins it. A clean, close cut will heal quickly and needs no paint or wax, unless a large limb has been removed.

Unfortunately, too many of our farmers and fruit growers neglect pruning their trees regularly, the result being that when they do begin, it is necessary to remove many large limbs. In cases of this kind it is not wise to do too much pruning in one season, as a severe pruning of the tree will cause so much young growth that it will be necessary to thin it out It will also expose the limbs which have been protected, and may cause sunscald. A better practice is to do it regularly. If large limbs are removed, the wounds should be given a coating of lead paint, which will protect them from weather and prevent rot from setting in until they begin to heal over.

It is a well known fact that winter or spring pruning tends to the production of wood; and summer pruning, to the production of fruit buds. The reason of this is that pruning before growth begins, or when it is beginning, destroys the balance between top and root, and there being then more sap supplied by the roots than the remaining top can elaborate, stronger growth is made or new branches formed to re-adjust this balance. If pruning or pinching off part of the new growth is done in the summer after most of the growth has been made, a part of the elaborated sap, which is as necessary to the production of strong roots as it is to the production of top, is removed, and the tree is checked in its growth and weakened, although the pruning should not be so severe as to make the latter apparent. A weakening of this kind tends to the development of fruit buds. Summer pruning to produce fruitfulness is, however, seldom necessary, and it is not recommended. If trees are given even a fair measure of attention they will reward the owner with abundant crops. Some varieties of apples do not come into bearing as quickly as others and often growers think that something is wrong with these trees when they

do not bear early. Root pruning, which also tends to weaken the trees and promote favourable conditions for the development of fruit buds, is sometimes advocated, but this, likewise, is seldom necessary. This is done by digging around the trees, and thus destroying part of their roots.

A branch which is broken or split by the wind or by weight of fruit may often be saved if it is carefully bent back to as near its original position as possible and bolted with an iron bolt. An auger hole is made through the broken branch and the uninjured part and a bolt run through. By doing the work carefully, the branch may be drawn almost into its original position by tightening the nut well. The bolt should be as near the size of the auger hole as possible, as the tighter the fit the better. The nut and end of the bolt are better large, as they will not sink so readily into the wood. After the bolting is done the ends of the auger hole should be closed up with grafting wax or paint, as the bolt will not fit tightly enough to exclude air, and germs of disease may enter. If the split or break is a bad one the branch should be headed back, so as to lessen the leaf surface. Although a branch may often be saved by treating it in this manner, a better practice is to bolt the trees before the branch breaks. A weak branch is often indicated by a splitting at the crotch, and if the bolt is run through then the branch is almost certain to be saved. It is sometimes advisable to brace the tree higher up, and this can be done with a longer bolt.

Patching up trees is not, however, on the whole a very satisfactory practice, and it may be avoided to a large extent by having trees without crotches, and this may in a large measure be accomplished by pruning the trees properly when young.

Trees are often ruined by neglecting to treat wounds or allowing rot to set in at the crotch. In such cases all the decayed part should be removed and the wood scraped back to living tissue, and in the case of rough wounds made by bruises or breaking of limbs, the edge and surface should be trimmed until quite smooth, so that healing may begin rapidly. These should now be painted, or, if not painted, sprayed with Bordeaux mixture to destroy germs of disease, and then covered with paint or grafting wax. Wounds should be kept covered with these substances until they are healing nicely.

MAINTENANCE OF FERTILITY.

When it is at all possible, it is much better not to remove any crops but apples from the orchard land after the trees are planted. When it is considered that the apple trees are to bear crops for fifty years or more on the same land, it may easily be understood that the trees to do their best will need all the plant food that they can get from the soil, and as much more as can be economically applied. If the soil is cropped with grass, cereals and roots, for instance, for eight or ten years, much plant food will be removed, and although these crops may be manured there is but a small percentage of people who will manure the land sufficiently to make up for the plant food removed. Furthermore, the moisture in the soil is lessened if other crops are grown, owing to the evaporation from the leaves of the growing crops, and as droughts now occur so frequently in some parts of the country, as much moisture as possible should be conserved for the use of the young trees. If other crops must be grown, they should be such as may be cultivated or hoed. Corn, although an exhausting crop, is one of the least objectionable crops to grow, as

it shades the trunks of the young trees. If other crops such as hay or grain are grown there should be four or five feet left on each side of the tree without any, and the strip thus left may be cultivated. If no other crops are grown in the orchard, the trees, if cultivated properly, will need very little manure until they come into bearing, as apple trees will grow quite thriftily when young on comparatively poor soil, as the exhaustion of the soil from the production of wood is small compared with that when large crops of fruit are removed.

Barn-yard manure is one of the best complete fertilizers where it can be procured cheaply and conveniently.

The weight of the fertilizing constituents which are removed from the soil in the production of a crop of apples when the trees are in full bearing has been estimated by careful analyses, and if about fifteen tons of fresh barn-yard manure were applied every three years, considerably more plant food would be restored to the soil than would be removed by the crops of apples. But as some of it will leach away and some never be reached by the feeding roots of the trees, it is wise to give a liberal dressing.

As in many places barn-yard manure cannot be profitably used because of its scarcity, the following extract from the report of Mr. F. T. Shutt, Chemist of the Dominion Experimental Farms, for 1894, will prove valuable to those who desire to maintain the fertility of their land by other methods than the application of barn-yard manure :—

'COMPOSITION OF THE FRUIT.'

Analysis of Apples.

'The general composition, viz., the percentage of water, organic matter and ash (which make up the whole) and the amount of nitrogen, are given for the four varieties examined in the following tabulated form :—

Name of Variety of Apple.	Water.	Organic Matter.	Ash.	Nitrogen.
Duchess of Oldenburg.	88·61	11·14	·25	·0382
Wealthy	87·00	12·71	·29	·0375
Fameuse	85·22	14·46	·32	·0512
Northern Spy	87·08	12·65	·27	·0445
Average	86·98	12·74	·28	·0428

Although there is a great similarity in composition in the varieties examined, and none differ much from the average deduced from them all, it is of interest to note that the Fameuse is the richest in organic matter, in ash constituents and in nitrogen. The Wealthy and Northern Spy contain almost identical amounts of organic matter and ash, and the Duchess of Oldenburg has the largest percentage of water and lowest percentage of organic matter and ash.

'PERCENTAGES OF IMPORTANT CONSTITUENTS IN ASH.'

Name of Variety of Apple.	Phosphoric Acid.	Potash.	Soda.	Oxide of Iron.	Lime.	Magnesia.	Silica.
Duchess of Oldenburg.....	8·90	53·67	3·28	1·77	5·80	5·20	·36
Wealthy.....	8·15	57·00	2·65	1·76	3·33	3·84	·63
Fameuse.....	7·19	56·25	2·56	1·26	3·55	4·03	·32
Northern Spy.....	11·68	54·11	1·94	2·13	3·86	3·99	1·11
Average.....	8·98	55·26	2·61	1·72	4·38	4·27	·60

In this table the composition of the ash in detail is given. Of its components, phosphoric acid and potash are the principal. The latter constitutes over half of the ash (55·26 per cent), while the former is about 9 per cent, the average being 8·98 per cent.

No great differences between the varieties are here to be noticed, though the Northern Spy presents some striking variations from the average. Its ash contains nearly 3 per cent more phosphoric acid, nearly 1 per cent less soda, about ·5 per cent more oxide of iron and alumina, and about ·5 per cent more silica than the ash of the other apples.

The ratio of the potash to the phosphoric acid in the ash of the fruit is 6 to 1; in the ash of the older leaves it is 2 to 1. Relatively, therefore, the demands of the leaf and the fruit on the soil of these two constituents are very different. It might here be remarked that the greater quantity of the ash ingredients of the fruit is contained in the seeds and walls of the ovary, comparatively little being found in the flesh of the apple.

A comparison of this table with that showing the composition of the ash of the leaf, will reveal further interesting features. The total percentages of ash in similar weights of leaf and fruit, are as 3·46 to ·28. Lime is much more abundant in the ash of the leaf, while magnesia, oxide of iron and silica are about the same, taking the older leaves for comparison.

For the purpose of a practical presentation of the subject, the data presented in the following table have been prepared:

'WEIGHT of Important Fertilizing Constituents withdrawn from the soil.'

Name of Variety of Apple.	Average weight per bushel in pounds.	NITROGEN.		PHOSPHORIC ACID.		POTASH.	
		Lbs. per barrel.	Lbs. per acre, or 160 barrels.	Lbs. per barrel.	Lbs. per acre, or 160 barrels.	Lbs. per barrel.	Lbs. per acre, or 160 barrels.
Duchess of Oldenburg.....	44	·046	7·359	·027	4·307	·162	25·975
Wealthy	50	·057	8·220	·032	5·181	·226	36·232
Fameuse.....	50	·070	11·223	·031	5·043	·256	39·456
Northern Spy.....	46	·056	9·006	·039	6·383	·185	29·570
Average.....	47·5	·057	8·952	·032	5·228	·217	32·808

NOTE.—In the above calculations the following data are used: Forty trees per acre in an orchard twenty-five years old yield, on an average, one hundred and sixty (160) barrels. One barrel contains two bushels and three pecks.

We have here the number of pounds of nitrogen, phosphoric acid and potash estimated as contained in one barrel of the fruit, and the amounts removed per acre by a good crop. None of the quantities are at all excessive, and the cost of returning them would not be great. The largest demand is on the potash in the soil; next comes the nitrogen, and lastly the phosphoric acid. In the case of the leaves, the nitrogen stood first.

For the vigorous development of the tree and an abundant crop of fruit, the soil must contain these constituents in a more or less *immediately available condition.* It is for this reason, as well as to replace the exhausted plant food, that fertilizers are necessary to profitable apple growing.

Nitrogen.—To supply nitrogen, some organic manure is perhaps the most economical. Barnyard manure or the turning under a leguminous crop (the latter being rich in nitrogen) are to be recommended. Besides adding nitrogen, they furnish humus or decaying vegetable matter, which serves a useful function by liberating carbonic acid, and which in turn sets free locked-up forms of mineral food. Humus, moreover, has much to do in bringing about good tilth and in the retention of soil moisture. As the period of growth and fruit development in the apple is comparatively long, organic manures in most instances will probably give better returns than those containing more soluble forms of nitrogen, such as nitrate of soda or sulphate of ammonia.

Potash and Phosphoric Acid.—To furnish potash and phosphoric acid, we would first mention wood ashes. In most parts of Canada they are the cheapest form in which to purchase these constituents. Moreover, they possess them in the relative proportion best suited to tree requirements and in a condition that renders them easily available.

If wood ashes are not obtainable, kainit and muriate of potash may be substituted to supply potash; and bone meal and superphosphate, the phosphoric acid. Bone meal contains 2 per cent to 3 per cent of nitrogen, in addition to the phosphoric acid, but requires a greater length of time in the ground to give up its constituents; its effects naturally last longer. For this very reason it is often advocated for orchard fertilization.

Both wood ashes and bone meal furnish lime, which we have seen to be a necessary and somewhat important element.

Soils differ so much in composition that it is impossible to state definitely the amounts of these fertilizers that should be employed in all cases. The wants of the tree for fruit and leaves have been given and the principles for an economical return of these requirements indicated. In conclusion, it may be said that the best and most profitable crops can be obtained only when the soil contains what might be thought to be a large amount of plant food, the greater part of which is more or less assimilable. A good tilth, among other advantages, tends to a good root development. In such the rootlets are able to procure food from a much larger area than otherwise; but in every orchard, owing to the disposition of the roots, there must of necessity be much unoccupied soil, and hence the importance of supplying liberally and in excess of that which is absolutely needed for a season's growth and fruit, those forms of plant food which we have been considering.'

Leaves in proportion to their weight contain a much larger amount of plant food than the fruit. The amount contained in 1,000 pounds of leaves

gathered in September was 8·87 pounds of nitrogen, 1·94 pounds of phosphoric acid, 3·92 pounds of potash, this being the average of five varieties analysed by Mr. Shutt.

CULTIVATION.

Of late years, orchard cultivation and management have received the serious attention of all progressive fruit growers. The droughts, which appear to be getting more prevalent in certain parts of Canada, have led to the adoption of methods which are more conducive to the conservation of moisture. The plant food, also, which is in the soil, is made more easily available by the tillage which many orchards now receive.

Shall we keep our orchards in sod or adopt clean cultivation? This is the question asked time and again at meetings of farmers and fruit growers, and something is to be said in favour of both methods, though, as a rule, and under most conditions, clean cultivation with cover crops will give the best results.

Many good crops of apples have been grown in orchards which are in sod. In fact, until recent years, comparatively few orchards were kept cultivated. If the soil is good and the trees never suffer from lack of moisture, and are in a thriving condition, it will not be necessary to cultivate. But how few orchards there are in which the trees do not suffer from drought when in sod, and where they thrive as well as they would if the land were cultivated! If grass is growing in the orchard a very large amount of moisture will be transpired through its leaves and the soil being thus deprived of it will be much drier, and the apple trees will suffer. Rain, which falls during summer showers, will often not soak through the sod, as it will be evaporated before it does so. When a thick sod is formed in the orchard the air does not penetrate as freely and the plant food, which requires the action of air to make it available for the use of the tree, will not become available so readily.

In the colder parts of the country where the apple will grow, however, the best plan will probably be to keep the orchard in sod, as the roots will be much better protected from frost. There will also not be as much growth as if the ground were kept cultivated and the wood on this account will be better ripened and more prepared to withstand the winter.

Cultivation of the soil in orchards offers such great advantages over non-cultivation that in the best apple growing districts it is unquestionably the better practice to adopt in most cases. When the surface soil is cultivated it forms a mulch and prevents the evaporation of moisture in a large measure. The air also is able to enter the soil very easily and nitrification takes place readily. With sufficient moisture and with plenty of plant food the trees will make vigorous growth and good crops of fruit will be borne.

Fruit growers who have followed the custom of keeping their orchards in sod, and who decide to cultivate them in future, should be careful not to break up the sod in the autumn, especially in those parts of the country where the winters are severe. The roots which have not been disturbed, it may be for years, will be near the surface and are likely to be injured, and are perhaps destroyed altogether by hard frost. It is better to plough in the spring. The first ploughing, to break up the sod, should be shallow, as it is not wise to destroy too many roots at one time. Sometimes, if the sod is not too thick, a spade or disc harrow can be used successfully instead of the plough.

If a clover crop has been left over the winter, it may be allowed to grow in the spring until there is a good crop to plough under, but in districts where droughts occur the land should be ploughed as soon as it is dry enough to work, not waiting for the clover to grow up ; thus much moisture which would otherwise be transpired by the leaves of the clover would be saved, and the chances of suffering from drought lessened, by beginning cultivation earlier than it is generally begun in some places. Ploughing should be done in alternate years towards and from the trees, so as to keep the soil level. The following extract from Bulletin No. 164 of the Michigan Experiment Station, giving the results of an experiment to test the amount of moisture in the soil, shows what may be saved by early cultivation :—

'Two tests were made of this question in Field No. 6. The plowing was done May 2. Samples were taken for determination of moisture on May 10 and 17, with the following results :—

May 10.	1st Foot.	2nd Foot.	3rd Foot.	Average 3 feet.
	Per cent.	Per cent.	Per cent.	Per cent.
Spring plowed	10·50	10·07	8·04	9·54
Not plowed	10·10	8·12	7·26	8·49
	·40	1·95	·78	1·05
May 17.				
Spring plowed	9·33	6·75	6·97	7·68
Not plowed	8·78	5·92	6·82	7·17
	·55	·83	·15	·51

'This gives a difference in the first instance of 2·8 pounds per square foot to a depth of three feet and 1·4 pounds in the second instance, in favour of the land ploughed early in the spring.

'Experiments tried by Professor King and reported in the Wisconsin Report for 1881, p. 101 and 102, show larger differences. The plowing was done April 29 and samples taken May 6, showing a difference for the upper three feet of 7·02 pounds of water per square foot. On another plot the observed difference of the samples taken May 14 to the same depth was 4·65 pounds.'

These determinations all show that to have as large a supply of moisture as possible for the crop it is necessary to plow or work the soil in some way to form a mulch to prevent evaporation as early in the spring as the condition of the land will allow.

After the land has been ploughed it should be harrowed or cultivated at intervals until about the middle of July. There is no fixed rule as to the number of times that harrowing should be done, as much will depend on the character of the season. The object, however, should be to keep the surface soil loose from spring till July. The soil should be cultivated after every shower of any consequence, and even if no rain falls it should be stirred at least once a week. Cultivation should cease in July, in order that late growth will not be encouraged, and that the wood may get thoroughly ripened. If cover crops are grown they will need the intervening time before winter to make the growth necessary to form a good protection for the roots of the trees.

Constant cultivation year after year has the effect of reducing the humus in the soil, and the system just recommended should not be followed too rigidly. Circumstances should guide the fruit grower as to the best methods he should adopt to maintain sufficient humus in the soil. At the Central Experimental Farm there is naturally very little humus in the soil, as most of the orchard land is a light, sandy loam. There is, however, sufficient moisture, and drought is not feared. The methods adopted here are, consequently, somewhat different from those recommended in most cases. The following extract from the Annual Report of the Horticulturist for 1898 will give the reasons for the course we have adopted.

COVER CROPS.

'The clover sown for cover crops on 1st August, 1897, in the orchards, mention of which is made in the report of the Horticulturist for that year, came through the winter in splendid condition. Nowhere was there any winter-killing and when growth began it was a fine sight to behold. On the 13th June clover in the crab apple, pear, and plum orchard was turned under. Part of this land was re-seeded on the 14th July, with Mammoth Red clover, at the rate of 12 pounds per acre, and part with about equal parts of Mammoth Red clover and Lucerne mixed. This formed a good covering by autumn. In a part of the apple orchard where the soil is very poor, the clover was ploughed under on the 26th May. The land was harrowed and pease were sown at the rate of 2½ bushels to the acre on 1st of June. On the 22nd July, when the pease were beginning to bloom, and about 2 feet 6 in. high, they were turned under, and, after harrowing, equal parts of Mammoth Red and Lucerne clovers were sown at the rate of 12 pounds to the acre. Owing to the very dry autumn, the Mammoth Red clover did not make as vigorous a growth as could be desired, but the Lucerne was 11 inches in height when frozen. These two crops of leguminous plants ploughed under this season will improve the texture of the soil and enrich it considerably. The clover in the greater part of the apple orchards was not ploughed under this year. This is contrary to what is usually recommended, but it was left for several reasons. In the first place, the soil in the orchard is a sandy loam which is easily moved by the wind. During the years in which the orchards have been under cultivation, the soil has blown away so much from a number of the trees that the roots are more or less exposed. A second reason why it was left, was to determine whether the trees would seem to suffer in time of drought. Notwithstanding the exceptionally dry summer which we had, neither the clover nor the trees seemed affected by the drought, except in a small portion of the Russian orchard. This would seem to indicate that the soil in the orchards does not lack moisture. Taking all things into consideration, namely, the texture of the soil, its capacity for holding moisture, the exposure of the orchard, the destruction of purslane, which it seems impossible otherwise to kill, even with thorough cultivation, and the belief that it is better not to encourage too vigorous growth when so near the limit of the successful growing of large fruits, it was thought better not to cultivate this year."

The objects of growing cover crops and the experience gained in growing them at the Central Experimental Farm were set forth in the annual report of the Horticulturist for 1899, as follows:—

'Since 1895, orchard cover crops have received much attention at the Central Experimental Farm, and in the reports of the Horticulturist for 1896,

1897 and 1898, considerable space has been devoted to this subject; but the importance of cover crops in the orchard cannot be too often nor too strongly impressed upon the fruit growers of Canada. After the disastrous effects of last winter on fruit trees in some parts of Ontario, the fruit growers living in those districts must realize more than ever before, perhaps, how necessary it is to have some protection for the roots of their trees.

It is now quite generally conceded that cultivation should cease in orchards in Eastern Canada about the middle of July. At this time the season's growth is well advanced and the ripening of the wood soon begins. The seed which is to produce the future cover crop should now be sown. In Eastern Ontario, the Common Red or Mammoth Red clover, sown broadcast at the rate of 12 pounds to the acre, will probably make the most satisfactory cover crop. It will reach a height of from 10 to 12 inches by winter, and will form a dense mat of foliage which will make a thick mulch, thus preventing the alternate freezing and thawing of the ground which occurs in late winter or early spring, and which often proves so disastrous to trees. After the seed is sown, the soil should be rolled with a heavy land roller, which will cause the moisture to rise to the surface of the soil and assist the germination of the seed. This rolling is very important, as, should the seed lie in the ground for any length of time without germinating, there will not be time for a good cover crop to be formed before winter. No nurse crop is, as a rule, necessary. In places where the soil is very dry, Lucerne or alfalfa might be sown with advantage, as the seed of this clover appears to germinate more readily than that of the Common Red clover. Cow peas and Crimson clover may be used in the warmer parts of the country.

Another advantage of clover growing in an orchard in autumn, is that much of the plant food in the soil which has been liberated and made more easily available by the constant cultivation during the early part of the summer, is prevented from leaching by being used by the growing plants, the clover thus becoming a 'catch crop,' as well as a cover crop.

Where soils suffer from lack of moisture in a dry time, the clover should be ploughed under as early in the spring as the land can be worked, and cultivation begun at once. This will conserve much of the moisture which would otherwise be transpired through the leaves of the growing plants until they were ploughed under towards the end of May, which is the usual time. If the soil, however, always contains plenty of moisture, it would be better to let the clover grow until about the third week of May, as there would be additional humus and nitrogen obtained by this method.

The great improvement made in the soil by the annual ploughing under of clover crops is shown by figures given by Mr. G. T. Powell, Ghent, N.Y., U.S., at the annual meeting of the Ontario Fruit Growers' Association, in 1899. After Crimson clover, which had been used as a cover crop, had been ploughed under in an orchard for three years, the soil was analyzed and the following differences were found between that where the clover had and had not been ploughed in:—

	Clover ploughed under for three years. Per cent.	No clover ploughed for three years. Per cent.
Water	15·00	8·75
Nitrogen	·21	·12
Humus	2·94	1·91
Phosphoric acid available	·015	·008

Although such good results would probably not be secured by the use of red clover, still the improvement in the land by such treatment would be very great.

For the reasons mentioned in my report for 1898, the methods which are recommended above have not been adopted at the Central Experimental Farm since the spring of that year. Clover is used for a cover crop, but it is only ploughed under every two years. As the soil here is light and lacking in humus, but apparently contains plenty of moisture, a system of cutting the clover with a field mower and leaving it to rot in the orchard, has been followed. In 1898 five cuttings were obtained, the clover being from 18 to 20 inches high at each cutting and just coming into bloom. It was estimated that from the first four cuttings 25 tons per acre of green crop were left lying on the field. Clover sown in 1898 was cut four times in 1899, and the crop from each cutting appeared fully as good as that of 1898. It can easily be imagined that this is improving the soil rapidly.

Common Red clover was sown in the orchards in 1899 on May 10, 17, 25 and 31; July 4, 11, 18 and 25. There was a good cover crop obtained from all of these sowings, with the exception of that on May 31, which did not germinate well, and from those of August 2, 9 and 16, at which time the weather was very dry and the seed did not germinate until September, and then but thinly. Clover sown on May 17 and 25 was nearly smothered by purslane, but eventually overtopped it and came on well and formed a good cover crop by autumn.

In a part of the apple orchard where the soil is very poor, two green crops were ploughed under in 1899. On June 10, clover which had formed a cover crop the previous winter was ploughed under and the land was then re-sown with buckwheat, soja beans, English horse beans and field pease, with the following results:—

Buckwheat.—Sown broadcast on June 17, at the rate of 2 bushels per acre; came up June 23. Ploughed under on July 25. Average height 27 inches. Estimated yield per acre of green crop: 8 tons 335 pounds.

Soja Beans.—Sown in drills 6 inches apart on June 17, at the rate of 3 bushels per acre; came up on June 24. Ploughed under on August 7. Average height 14 inches. Estimated yield per acre of green crop: 3 tons 466 pounds.

English Horse Beans.—Sown in drills 6 inches apart on June 17, at the rate of 4 bushels per acre; came up on June 27. Ploughed under on August 7. Average height 18 inches. Estimated yield per acre of green crop: 6 tons 592 pounds.

Field Pease.—Sown in drills 6 inches apart on June 17, at the rate of 3 bushels per acre; came up on June 24. Ploughed under on July 29. Average height 26 inches. Estimated yield per acre of green crop: 5 tons 1,191 pounds.

After these crops were ploughed under the land was re-seeded with clover on August 2, 9 and 16, in the hope of getting a cover crop by winter, but owing to nearly six weeks of very dry weather about that time the seed did not germinate until September and a cover crop was not formed. The trees in this part of the orchard were mulched with manure.

On July 6, English horse beans were sown in a part of the orchard where the soil was light and where the snow does not lie well in winter. On July 16, after the beans were up, Common Red clover was sown among them at the

rate of 12 pounds per acre. The beans reached a height of 18 inches by autumn and helped very much to hold the snow while they must have gathered much nitrogen during the growing season. There was also a good stand of Common Red clover.

On July 25, Lucerne clover was sown in a part of the orchard where the soil was very light. It reached a height of from 7 to 12 inches by autumn, and although there was a large number of plants destroyed by a storm carrying away the surface soil, there was a fairly good cover crop."

The advantage of using leguminous plants, such as those referred to, for cover crops is that by means of the nodules, or tubercles on their roots they are able to assimilate free nitrogen from the air, and thus add much of this expensive plant food to the soil without cost to the grower. The Hairy Vetch (*Vicia villosa*), another leguminous plant, has given great satisfaction where it has been used. It is a rapid grower and is not injured by light frosts.

In addition to the leguminous plants mentioned above, rye and buckwheat make good cover crops and are often used by fruit growers for this purpose. They have, however, the disadvantage of not adding any more plant food to the soil than they take out of it during their growth.

RENOVATING ORCHARDS.

Many orchards have been neglected so long and have reached such an age that it will not be profitable to attempt to renovate them, and the best plan would be, in such cases, to plant young trees. On the other hand there are many orchards where the trees, if cared for, would be in the prime of life, and neglect is the only cause which prevents profitable crops from being grown. It is of orchards such as these that a few suggestions are offered as to how to bring them back into good condition. The results desired cannot be accomplished in one year.

To begin with, the trees should be pruned, not too heavily at first, but enough limbs should be taken out to open up the top and permit a free circulation of air and the admission of sunlight to it. The trees will probably be much moss grown, and both they, and the fruit, affected with various diseases, and injurious insects are almost certain to abound. Spraying should be begun early in the season, as recommended in the spraying instructions in this bulletin, and the trees should be kept covered from top to bottom with Bordeax mixture and Paris green until the fruit is almost fully grown. Scraping the trunks and large branches of the trees may be done if there is much moss, but as soon as the tree becomes more vigorous, and air and sunlight are admitted, much of the moss will disappear. If the oyster-shell bark-louse or other scale insects infest the trees, they should be sprayed with the lime mixture, or other materials mentioned in the spraying calendar. As the orchard, if neglected, is almost certain to be in sod, the soil should be ploughed shallow in the spring, turning under a good dressing of manure if it can be procured. If the sod is not too thick it might be worked up with the disc or spade harrow. The ground should then be kept thoroughly harrowed until July, working in other fertilizers if the land is poor and manure is not to be had, and then red clover seed sown at the rate of twelve pounds per acre and the

ground rolled. A good cover crop should be formed by autumn. This would conclude the first season's work. The results would probably be a greatly increased vigour in the trees, and the fruit, though perhaps not plentiful, would be cleaner. The second season, additional, but less, pruning should be done, the trees kept thoroughly sprayed as before, the clover ploughed under in the spring, and the land kept harrowed or cultivated till July, and then seeded down to clover. The fruit should be better than the year before, but not until the third year should the trees be expected to bear heavily and the orchard be in good condition.

PICKING AND PACKING.

It is difficult to give exact information as to the best time to pick apples. Each fruit grower must learn this from personal experience. Some varieties require to be picked at one stage of maturity, and some at another. There are, however, several general directions which may be given. Early apples

Picking apples in Niagara District, Ontario.

which are intended for near markets should be picked when almost mellow, and disposed of as soon as possible, as their season is short. The best way of putting up early apples is in 10 to 20 lb. baskets with leno covers For export purposes they should be picked when well coloured but still firm. Experience will soon teach the best time to pick for this purpose. Winter

apples may be left on the trees until there is danger of injurious frost. In large orchards it is necessary to begin picking in good season, and the different varieties will have to be taken in succession, beginning with the early winter sorts and those varieties which drop easily. An apple before being picked should have its seeds almost mature, and have taken on most of its colour. As seasons vary considerably, judgment has to be shown as to the best time to gather the fruit. It often happens that a good crop of apples of the best quality is ruined by improper picking or gathering. Winter varieties appear so hard when they are picked that one might be led to think a little careless handling would have no injurious effects upon them, but this is not the case. Apples are easily bruised, and some varieties much more easily than others. When an apple is bruised, its appearance is often spoiled for the home market and its shipping qualities very much lessened for the export trade. The bruises of some varieties, while disfiguring the fruit, do not cause the apple to rot rapidly ; on the other hand, there are many varieties which will rot rapidly when once bruised. Bruises may be avoided by careful handling and nothing should induce the practice adopted by some people of shaking the apples from the trees.

There are many kinds of receptacles for picking apples in, but half bushel baskets are about as convenient and satisfactory as any. They should be lined with some soft material to prevent bruising, as too much caution cannot be taken in this regard. A hook may be fastened on the handle so that the basket may be suspended while the picker is at work. The easiest way to remove the apples from the branch will soon be learned. The stem should remain on the apple, as if broken off decay is more likely to set in. The fruit may be either sorted immediately or taken to a store house and done at some future time. Many of the best growers sort and pack in the orchard, and certainly the fruit has much less danger of being bruised if treated in this way. A sorting board covered with some soft material is arranged at a convenient distance from the ground on which the apples are emptied from the baskets. They are then usually sorted into three grades, namely, firsts, seconds and culls. The firsts and seconds are put in baskets as selected and the culls thrown to one side. These baskets should be small enough to go into a barrel, should the latter be used. Machines for grading and sizing fruit have been used for this work in recent years, but, unless the fruit is free from scab or codling moth, the hand will have to be used also. The usual practice is to face the end of the barrel with two layers of apples placed neatly and tightly in it with the hand. These should be a fair sample of the kind of apples which are in the middle of the barrel. The other apples are now gently emptied out of the baskets into the barrel and the fruit is made to settle down by rocking the barrel from time to time. This is a very important factor in successful packing. The last row of apples should come slightly above the heading groove. The apples are pressed into place by means of a lever, and a circular band lined with felt just fitting the barrel, until the top boards can be fitted in. If the apples have been well shaken when being put into the barrel very little pressing is necessary. As all the pressing that is required is to keep the apples from moving, the more pressure that is put on, the greater quantity of bruised apples there will be. Some yielding material, such as excelsior or felt, placed in each end of the barel would lessen the amount of bruised fruit very much.

The choicest fruit packed in bushel boxes brings high prices in England. When packed in this way every specimen should be uniform and perfect.

During the past few years dishonest packing seems to have been growing in Canada, the result being that the reputation of Canadians and Canadian fruit has suffered very much and it will require some years before confidence will again be restored. Apples have been packed in such a manner that the fruit at either end of the barrel gives a very false impression of that in the middle. An Act has recently been passed which will prevent such fraud.

For the information of fruit growers in grading their fruit when packing, the following quotations are made from the Act:

'Every person who, by himself or through the agency of another person, packs fruit in a closed package, intended for sale, shall cause the package to be marked in a plain and indelible manner, before it is taken from the premises where it is packed,—

(*a*) with the initials of the Christian names, and the full surname and address of the packer;

(*b*) with the name of the variety or varieties; and

(*c*) with a designation of the grade of the fruit.

'No person shall sell, or offer, expose or have in his possession for sale any fruit packed in a closed package, upon which package is marked any designation which represents such fruit as of finest, best or extra good quality, unless such fruit consist of well-grown specimens of one variety, sound, of nearly uniform size, of good colour for the variety, of normal shape and not less than ninety per cent free from scab, worm holes, bruises and other defects, and properly packed.

'No person shall sell, or offer, expose or have in his possession for sale, any fruit packed in any package in which the faced or shown surface gives a false representation of the contents of such package; and it shall be considered a false representation when more than fifteen per cent of such fruit is substantially smaller in size than, or inferior in grade to, or different in variety from, the faced or shown surface of such package.'

Some of the best packers pick the fruit, pack it, and close the barrels or cases all in the same day; others pick and pack it the same day, but take it to a store room to cool off over night and then close the barrels or cases the next day. Others, again, do not close them until ready for shipment, and still others do not pack their fruit until they desire to ship it, but merely keep it in boxes or bins. All these systems have their advocates. The best method is probably the second, namely, to pick and pack the fruit the same day, but allow it to cool down before closing the barrels or cases. If the weather is cool they may be closed when packed.

STORING.

If the fruit is not disposed of at once it should, as soon as it is picked or packed, be put somewhere where the temperature may be controlled and the fruit kept cool. Every fruit grower who has a large orchard should have a proper place for storing his fruit. It often happens that at the time of picking,

the prices for apples are very low. If a grower has not a proper place to store them he is obliged to sell, while if he were able to hold them for a time, better prices would be obtained. This was strikingly the case in 1900.

A cellar often answers the purpose of a storeroom, but it takes a large cellar to store fruit from a large orchard. For most varieties of apples a well ventilated room above ground with comparatively dry air, the temperature of which may be kept low, is the best. Apples such as Russets which shrivel easily keep better in a moist atmosphere. A fruit building may be erected without a great expenditure of money. It should be built in such a manner that the warm air may be kept out and the cooler air kept in, or vice versa. The temperature should be kept as cool as possible in the autumn, and in the winter it should be maintained at from 32°F. to 35°F. The cooler apples are kept without freezing, the better.

Apples may be kept in such a building until they are required for shipment. If they are kept late into the winter they should be repacked before shipping, to avoid sending away anything that will be a discredit to the grower and a loss to the consumer.

In houses in cities it is often difficult to get a place where the temperature may be regulated, as it is usually either too warm or too cold. However, the coolest place should be chosen where there is no danger of frost. If there is a choice of two rooms that with the moister atmosphere would be the better, for, as a rule, the air is too dry for keeping apples properly in a city house. If the apples are in good condition and none of the specimens show signs of rotting they may be left in the barrel or box. If, however, they show signs of rotting they should be sorted and the perfect specimens wrapped in paper. If the room is very dry it will be better to put them back in the barrel, after wrapping, as they will shrivel less when kept in a mass where the air will not get at them so readily.

As the export of the early and tenderer fruits to Great Britain increases, the need of cold storage buildings will be felt and more of them will be erected. The temperature in such buildings will have to be kept down by means of ice or by some other artificial method, as the ordinary storeroom could not be kept cool enough in the heat of summer. To ship early apples to Great Britain successfully it is necessary to pick them before they are fully mature, and keep them constantly cool in the cold storage house, refrigerator car and steamer until they are landed in Great Britain. If they are subjected to a warm temperature between the time they are picked and when they reach the other side of the Atlantic they will be likely to prove a failure.

MARKETS.

The demand for Canadian apples of good quality and in good condition is an ever increasing one. In Great Britain the market appears to be unlimited and the prospects for opening an extensive trade with other European countries, also, are very bright. The Canadian fruit growers, packers and shippers should see to it that the fruit which is exported is well and honestly packed and that it is of such quality as will increase the demand for it even more than in the past.

At home, also, the consumption of apples is increasing, and when better rates are given by the railways so that the apples may be shipped at less cost

than at present there will be a great demand for this fruit by those who live in those parts of Canada where apples cannot be grown successfully.

SPRAYING.

Although plants have been treated to prevent and exterminate fungous diseases and insect pests for many years it was not until poisons dissolved and mixed with liquids began to be used extensively for field work that spraying became an important part of successful fruit culture.

When the value of sulphate of copper as a preventive of the fungous diseases of fruits had been discovered, the value of spraying began to be impressed very strongly upon fruit growers. This discovery was made at Bordeaux, France, in 1882, but it was not until 1885 that the first formula was published. The mixture of sulphate of copper, lime and water, then recommended was a very thick and strong one and was applied by means of small brooms. The Bordeaux mixture, as it has been called, was soon tried in America. Experiments were made, and it was not long before it was found that a much thinner and weaker mixture could be used and by 1892 the same formula, practically, as is now recommended, was adopted.

Paris green, one of the most important insecticides, was first used for the destruction of biting insects injurious to fruits about 1872 or 1873, but was not used extensively for this purpose until four or five years afterwards. Its effectiveness is so apparent and it is so easily recognized by its bright green colour that it has become very popular. It is now usually applied with Bordeaux mixture on apple trees by which it looses none of its value.

Whale oil soap which is one of the best insecticides for sucking insects was recommended before the Massachusett's Horticultural society in 1842 as a remedy for thrips, red spider and other insects; but it is now used largely for destroying scale insects and aphides. Some of the whale oil soaps in commerce are made from soda, but in order to be effective when used as insecticides they should be made from potash and not from soda

Kerosene Oil.—The first published record of the use of this insecticide was in the Gardener's Monthly, December, 1865, when it was recommended for destroying scales on orange and other trees. Cook, of the Michigan Agricultural Experiment Station, appears to have been the first experimenter to recommend the kerosene emulsion, which he did in 1878. Kerosene and water are now used for destroying sucking insects, but the oil often injures the trees and great care has to be taken with it. Kerosene emulsion is a good remedy for sucking insects, but is not as readily made as some others, and on this account has not been as popular as it otherwise would have been.

Crude petroleum has for the past two years been recommended as a remedy for the San José Scale, Dr. J. B. Smith, New Brunswick, N.J., having done most to bring it into prominence through his experiments. It has been very effective in some instances and in others it has not, while sometimes it has proven injurious to the trees. Crude petroleum is not uniform in composition and hence has to be used with caution.

Tobacco has been used for a long time as a remedy for sucking insects and is one of the best in use at the present time. There is little danger of injuring trees with it, yet it is very effective in killing soft bodied insects such as aphides. Tobacco water is easily made and applied.

Lime is a very useful substance in spraying. It has made both sulphate of copper and Paris green quite safe to use in proportions which would otherwise be injurious to foliage. It was recommended as long ago as 1850 as a remedy for plum curculio and it has proven very effective in destroying the pear-tree pyslla. The whitewashing of the trunks of trees is an old custom, and while it was not always known why the lime was applied, the results must have been good or the custom would not be such an old one. In 1899 it was discovered by the Horticulturist at the Central Experimental Farm that lime was very effective in ridding trees of the oyster-shell bark-louse, and this new use of lime should prove of much value to fruit growers where this insect is prevalent.

Apple tree sprayed with lime wash to destroy oyster-shell bark louse.

With the development of spraying came the development of spray pumps and nozzles, as, up to the time of the advent of Paris green and Bordeaux mixture, the pumps and nozzles used were not very suitable for the purpose, but these have been so perfected during the past few years that it is now difficult to find where an improvement can be made. Many intermediate pumps may be had between the small hand syringe and the powerful pump fitted to a forty gallon barrel, by means of which the tops of the highest apple trees may be reached with the spray. For orchard work it is most economical to get one of the best and most powerful pumps made. These can be obtained for from $18 to $24. Smaller pumps may be bought, but they are not suitable for orchard work. If, however, an extension rod is obtained, cheaper pumps may be used in gardens where there are but few trees and where most of the spraying is done on small fruits and vegetables. Such pumps may be obtained for from $5 upwards.

At the Central Experimental Farm much attention has been given to spraying. In the first annual report, being that for the year 1887, the Entomologist published formulæ to be used, and in every report since has insisted on the necessity of spraying. Before the experimental farms were established he had, in his report to the Minister of Agriculture for 1885, published formulæ from his own experiments. Since 1890 many experiments have been conducted by the Horticulturist and Entomologist to determine the best formulæ to adopt, and if possible to discover some new remedies. In addition to the information given in the annual reports the following publications have been issued on spraying, 'Treatment of Apple Scab, Grape and Gooseberry Mildew' (Bulletin 10, 1891) by J. Craig. 'Recommendations for the Prevention of Damage by Some Common Insects of the Farm, Orchard and Garden' (Bulletin 11, 1891) by J. Fletcher. 'Spraying for the Prevention of Fungous Diseases and Injurious Insects' (Bulletin 23, 1895) by Fletcher and Craig. Spraying calendars by Fletcher and Craig in 1895 and 1897, and by Fletcher and Macoun in 1899 and 1901.

As the advantages of spraying have been thoroughly proven and demonstrated by men who have been employed by the Government to do this work, and as the matter has been written about time and again in reports, bulletins, periodicals, newspapers and spraying calendars, one might be led to think

that all farmers and fruit growers would now spray their trees as a matter of course, just as they plough their fields; but this, unfortunately, is not the case, and there is still a large proportion of men engaged in fruit growing who do not spray. There is also another class of men who, knowing that spraying with Bordeaux mixture and Paris green will materially lessen the amount of scab and codling moth, do spray their trees, but are not satisfied with the results; the reason of the poor success being, either that the mixture is not properly made, the trees are not sprayed thoroughly, or the spraying is not done at the proper time. Spraying is an expensive operation, and it is surprising that so many continue to waste hard-earned money by not doing the work properly. The early sprayings are the important ones, and these are too often neglected on account of press of other work, and when spraying is begun it is often too late to be of much service. A certain number of sprayings are suggested in the spraying calendars, and the times when they should be made. It should, however, be impressed on those who spray, that if heavy rain occurs before the mixture has dried on the trees, it will be washed off and the work must be done over again. The neglect of this is probably one of the chief causes of poor success in sprayiug. Spraying should be done thoroughly, and the underside of the leaves should receive as much of the spray as the upper sides. Every leaf or fruit missed means a foothold for disease or insect pests. In preparing the mixtures and solutions, the formulæ given on the spraying calendars prepared by the Central Experimental Farm and similar institutions, should be followed as closely as possible. If a man knows the chemical composition of the materials he uses, and has made a study of spraying, he may alter them slightly to meet certain circumstances, but if his knowledge of the materials used goes no further than the name, he should follow the instructions closely. He should also do his spraying at the seasons suggested. A delay of a few days may mean the loss of practically all the mixture or solution used without getting anything in return.

Spraying calendars are published, from time to time at the Central Experimental Farm, conjointly by the Entomologist and Horticulturist in which are given full instructions for the preparation of the various formulae recommended and the time at which each spraying should be made.

DISEASES AND OTHER INJURIES TO APPLES AND APPLE TREES.

Apple Blight or Fire Blight (*Bacillus amylovorus*). This disease often does much injury to apple trees. It is usually first indicated by the sudden drying up of the young twigs and spurs. Often whole branches will be affected and sometimes the trunk itself, causing the tree to die or become practically useless. The bacteria which cause the disease enter through the blossoms and bark of the tree. The Russian varieties of apples appear more subject to it than others. There is no known preventive or good remedy. Affected twigs and branches should be cut off about a foot below the affected part and burned to prevent the further spread and dissemination of the disease.

Black Spot Fungus or Scab (*Fusicladium dendriticum*). During recent years the apple scab fungus has been very troublesome, often injuring the fruit so badly that it is quite unsaleable. The disease attacks the tree in early spring and is first noticeable as light green patches on the young leaves. The fruit may be affected as soon as formed and if badly diseased will drop off. As the fruit increases in size the diseased patches enlarge and nearly all the surface

is often covered with the black spots before the fruit is picked. In addition to the disfigured appearance of the fruit, caused by this disease, the apples do not reach their full size. The apple scab develops most rapidly in moist weather. This disease may be almost entirely prevented by the proper use of Bordeaux mixture, the remedy recommended at the end of this paragraph. While a certain number of applications are recommended, more wil have to be given if the season is wet. The object should be to keep the trees covered with the mixture from the first until the last spraying. If the mixture is washed off the tree the disease will have an opportunity of developing and it is difficult to check it, if it begins to spread.

REMEDY.—Spray with copper sulphate solution (1 lb. copper sulphate to 25 gallons water) before buds start; and with Bordeaux mixture, just before blossoms open; soon after blossoms fall and two or three times after at intervals of from 10 to 15 days. The first three sprayings are the most important.

Crown Gall (*Root Gall*). Indicated by hard, gall-like masses on the crown and sometimes on the roots of apple trees, particularly on young trees. These galls often interfere very much with the circulation of sap in the trees, causing them to become sickly, and frequently resulting in their death. The roots of most of the large fruits are affected, and in the United States the losses from this disease have been very great. Until recently, it was not known what caused this injury. It was thought by some that the galls were simply malformations caused by the injury to the tree or were produced by unsuitable soil, by others, that they were produced by a parasitic fungus, and again, that they were caused by insects. This disease has been given much study recently by J. W. Toumey, of the Arizona Agricultural Experiment Station (see Bulletin 33). His conclusions are that it is caused by a parasitic slime-mould, the spores of which may be readily disseminated by the wind or by other means. No remedy has yet been found, and trees affected with it should be destroyed and burned to prevent its spreading. If the galls are removed, only, they will grow again. No trees should be planted which have had these galls upon them.

Dry Rot.—This is a disease which affects the fruit and is indicated on the exterior of the apple by small circular depressions. When the skin is removed, dryish, brown tissue is found at the diseased spots, and when the fruit is badly affected this brown and pithy condition may be seen extending through much of the fruit. The diseased flesh is not bitter but is dry, tough and without flavour. When the apple is badly affected its commercial value is almost destroyed. Various causes have been assigned to this disease, namely, want of vigour of tree, lack of moisture in the soil, want of potash and lime in the soil. By those who have given most study to the rot it is ascribed to the concentration of sap caused by the transpiration of moisture, which causes the death of the cells. There is not yet any known remedy for this disease, but it will probably not be as troublesome if there is plenty of moisture in the soil, and if the trees are encouraged to make good, healthy growth.

Sunscald.—The injury to apple trees known as sunscald is one of the most serious hindrances to successful apple culture, particularly in the northern and eastern parts of Ontario and in the province of Quebec. Newly planted trees are, as a rule, more seriously affected by it than older ones, but both often suffer badly. The unhealthy appearance of the bark and wood on the south and south-west sides of the trunk of the tree and on the larger branches is the first indication of this injury. Afterwards the bark and wood dry up and fall away. Trees are often so badly affected that they die. This injury occurs

during the latter part of winter or very early in spring when there are warm days and cold nights. This injury may be prevented to a large extent by only planting trees which are headed low, thus exposing but a short trunk to the rays of the sun; also by inclining the young trees somewhat to the south when planting, thus preventing the sun's rays striking the trunk except for a short time. Where trees have been planted and are liable to become sunscalded, the trunks may be protected by using a veneer of wood which encircles the trees, thus preventing the rays of the sun from striking the trunk. It should be loose so that there will be an air space between it and the tree. The ends of it can be fastened together by means of wire. Another protector is made of finely meshed galvanized iron netting which is more permanent than the wooden protector. In outlying districts where these protectors cannot be purchased, a good substitute may be made out of birch bark. Building paper tied around the tree is also useful. All of these protectors are effective in preventing the ravages of mice. Cornstalks, boards, and many other things may be used to protect the tree from sunscald. Nothing, however, that will be likely to harbour mice should be used. When a tree has been injured by sunscald the injured parts should be carefully cleaned away and the wound covered with grafting wax or paint. If the tree is young and likely to suffer, it should be protected in the manner described above.

Mice.—Mice often girdle the trees in the orchard in winter, especially when it is in sod or when there is rubbish lying about in which they like to harbour. Everything in the way of rubbish should, however, be removed before winter. Their depredations may be prevented either by wrapping the trunks with building paper in autumn and banking up the earth about the base to the height of about a foot; by encircling the trunk with fine galvanized iron netting; or by using the veneer protectors used to prevent scalding. Where the latter are used the earth should be banked up a little at the base to prevent the mice from going underneath.

If a tree is girdled by mice it usually dies. If, however, as soon as the injury is noticed, the wound is cleaned and covered with grafting wax and wrapped with cloth so that the air is excluded and the wood prevented from drying out, the sap which rises through the soft wood will continue to do so and returning through the inner bark, growth will be made all around the upper part of the wound, and if the latter be not too large there is a chance of its healing over. If, however, the wood becomes dry before the bandage is put on it will almost certainly die. When the wax and bandage are applied the tree should be headed back considerably to lessen the amount of transpiration of moisture, as there will not be as much sap rise as if the tree were uninjured. Girdled trees are sometimes saved by connecting the upper and lower edges of the girdle with scions, which are inserted all around the trunk. Mice may be destroyed in the orchard by using a mixture of one part by weight of arsenic with three parts of corn meal. To use this safely nail two pieces of board each six feet long and six inches wide together so as to make a trough. Invert this near the trees to be protected and place about a tablespoonful of the poison on a shingle and put it near the middle of the run, renewing the poison as often as is necessary.

APPLE INSECTS.

By James Fletcher, Entomologist and Botanist.

In a condensed consideration of the most important insect enemies of the apple grower, it may be pointed out that these may be divided under the following headings:—

Those which devour the foliage;
Those which bore in the wood;
Those which occur on the bark; and
Those which attack the fruit.

All insects fall within two classes which can be separated by the nature of their mouth parts. A consideration of this point is of the utmost importance in the intelligent use of remedies. In the first class, Biting Insects, which have jaws with which they consume the substance of their food, as caterpillars, all that is necessary is to place on the food plant some poisonous material which will be eaten with the food. In the second class, Sucking Insects, which instead of jaws have a beak or hollow tube with which they suck up their food in a liquid form, as the plant-lice, something must be used which will kill by mere contact with their bodies.

For some insects such as borers in the wood, which cannot be reached by the above remedies, preventive measures may be taken by which the plants are rendered distasteful to the mature insects when seeking a suitable place to lay their eggs. For this purpose, various alkaline or strong-smelling deterrent washes are used.

The following are the formulæ of standard remedies which are recommended by the Entomologist and Botanist:—

INSECTICIDES AND FUNGICIDES.

I. Kerosene Emulsion.
(*Riley-Hubbard formula.*)

Kerosene (coal oil)	2 gallons.
Rain water	1 gallon.
Soap	½ lb.

Dissolve soap in water by boiling; take from fire, and, while hot, turn in kerosene and churn briskly for 5 minutes. To be diluted before use with 9 parts of water.

II. Paris Green.

Paris green	1 lb.
Lime (fresh)	1 lb.
Water	200 gallons.

For dry application. 1 lb. Paris green with 50 lbs. flour, land plaster, slaked lime or any other perfectly dry powder.

III. Whale-oil Soap.

For scale-insects (young)	1 lb.	in 5 gallons water.
For aphis	1 lb.	in 8 gallons "
For San José scale (in winter)	2 lbs.	in 1 gallon "

IV. Tobacco and Soap Wash.

For Plant-lice or Aphis.

Soak in hot water for a few hours 10 lbs. of tobacco leaves (home grown will do); strain off and add 2 lbs of Whale-oil soap. Stir until all is dissolved, and dilute to 40 gals. Apply early and two or three times at short intervals.

V. Alkaline Wash.

For Borers.

Soft soap reduced to the consistency of thick paint by the addition of a strong solution of washing soda in water. If applied with a brush during the morning of a warm day, this will dry in a few hours and form a tenacious coating not easily dissolved by rain.

VI. Poisoned Bordeaux Mixture.

For Fungi and Insects on Fruit-trees.

Copper sulphate (blue-stone)	4 lbs.
Lime (fresh)	4 lbs.
Paris green	4 oz.
Water (1 barrel)	40 gallons.

Dissolve the copper sulphate (by suspending it inside a wooden or earthen vessel containing 4 or 5 or more gallons of water.) Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place; half fill the barrel with water, add the slaked lime, fill the barrel with water and stir thoroughly. It is then ready for use.

Stock solutions of dissolved copper sulphate and of lime may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of bluestone, lime and water should be carefully noted.

VII. Copper Sulphate Solution.

Copper sulphate (blue-stone)	1 lb.
Water	25 gallons.

As soon as dissolved it is ready for use. *For use only before the buds open.*

Caution.

For the purposes of this note the operating of "Spraying" consists of applying liquids by means of a force pump and spraying nozzle with such force as to break up the liquid so thoroughly that it falls upon the plants treated as an actual mist or spray. Such terms as *sprinkling* and *showering* are inaccurate for the operation here intended. Unfortunately much of the so-called spraying as usually carried out could more accurately be designated by these terms, which describe a much less careful and less even distribution of liquids.

THE WORST ENEMIES OF THE APPLE TREE.

ATTACKING THE FOLIAGE.

1. THE EYE-SPOTTED BUD-MOTH (*Tmetocera ocellana*).—Small, dark brown caterpillars, ¼ of an inch in length, with black heads and collars, destroying the buds when just unfolding, and sometimes boring down the centre of the twig. *Remedy:* Spray early with a strong Paris green wash (Paris green 1 pound, fresh lime 1 pound, water 100 gallons).

2. THE CIGAR CASE-BEARER (*Coleophora fletcherella*) and
3. THE PISTOL CASE-BEARER (*Coleophora malivorella*).—Small yellow caterpillars in curved cases, which pass the winter on the twigs of apples and cluster around the opening buds, injuring the foliage and flowers. *Remedy:* Spray early with the wash mentioned under No. 1 above, or with kerosene emulsion (Formula I).

4. LEAF-ROLLERS.—The caterpillars of several small Tineid moths, when full-grown from ¼ to ½ inch in length, which bind together the young leaves and flower buds, forming a tent inside which they feed. *Remedy:* The same as for No. 1.

5. TENT CATERPILLARS (*Clisiocampa*).—Two kinds attack the foliage of the apple as well as of many other trees. The Apple-tree Tent Caterpillar forms a tent in the fork of two twigs; the Forest Tent Caterpillar does not make a conspicuous tent, but spins a flat mat of silk on the side of a branch or on the trunk; to these resting places the young caterpillars resort when not feeding. The mature insects are thick-bodied, reddish brown moths expanding about 1½ inches across the wings, which are crossed obliquely by two bands. These bands are pale in the first-named, but dark in the moth of the Forest Tent Caterpillar. During July the females lay rings of about 200 eggs on the twigs of trees, in which state the insect passes the winter. *Remedies:* Collect and destroy the egg clusters during the winter. Spray the trees with poison (Formula II or VI) directly the young caterpillars are noticed. All tents should also be cut off and destroyed early, before the leaves hide them.

6. GREEN FRUIT WORMS (*Xylina*).—Green caterpillars dotted and lined with yellowish white, 1½ inches long, occasionally attacking the foliage and the forming fruit. *Remedy:* Spraying regularly with Formula VI will prevent injury from these insects.

7. CANKERWORM (*Anisopteryx pometaria*).—Silver brown caterpillars about an inch in length, with only six pairs of legs, occurring sometimes in large numbers, attacking the leaves so severely as to give the trees the appearance of having been scorched with fire. The wingless female moths appear only in autumn and climb up trees to lay their eggs in flat patches on the bark. From these the young caterpillars hatch in spring. *Remedies*: Spray as soon as caterpillars appear with Formula II or VI. In autumn, place mechanical contrivances or bands of thick paper painted with a mixture of castor oil 2 pounds, rosin 3 pounds; or with printer's ink, or some other viscid substance to catch the females when ascending the trees to lay eggs.

8. THE APPLE APHIS (*Aphis mali*).—During winter small shining black eggs may be found on the twigs. From these, early in spring, green plant-lice hatch and cluster on and in between the young leaves of the opening buds. They also occur in large numbers beneath the leaves in autumn. *Remedies*: Tobacco and soap wash (Formula IV.), whale-oil soap (1 lb. in 8 gallons of water, Formula III).

ATTACKING THE WOOD.

9. BORERS: FLAT-HEADED BORER (*Chrysobothris femorata*), ROUND-HEADED BORER (*Saperda candida*).—The above named are the two commonest kinds of borers which attack the apple. They vary somewhat in their habits, but the best remedy for both is undoubtedly a regular treatment every June just before the time the eggs are usually laid, with deterrent washes, such as Formula V or the same with crude carbolic acid added in the proportion of 1 pint to 4 gallons of the wash, to be applied with a large brush to the bark of the trunks and larger limbs. When a tree is infested, the presence of the grub may be detected by the borings which it pushes out of its burrows and by the sunken discoloured appearance of the bark. By cutting through the bark the grub can be destroyed. If it has penetrated into the wood, it can be killed with a piece of stout pliable wire.

OCCURRING ON THE BARK.

10. THE SAN JOSÉ SCALE (*Aspidiotus perniciosus*).—Minute almost circular scale-insects, one thirtieth of an inch wide, shaped like an inverted saucer with a depressed ring around a central point. Inside this ring, black or dark-coloured This very inconspicuous insect, when in small numbers, is easily overlooked, but when abundant gives to the bark a dirty, scurfy and grayish colour as though dusted with ashes. *Remedy:* This is by far the most difficult insect to eradicate which the fruit growers have ever had to deal with. In cases of bad infestation the destruction of infested trees with fire will be found the most economic course. The two treatments which have given the best results, are the spraying of trees in winter or before the buds burst with whale-oil soap solution (2 lbs. in 1 gallon of water) or with a 25 to 30 per cent application of crude petroleum and water. Experiments are now being carried on to discover a more effective safe remedy for this insect.

11. THE OYSTER-SHELL BARK-LOUSE (*Mytilaspis pomorum*).—Small scale-insects furnished with a beak and protected by a waxy scale one-tenth of an inch in length shaped somewhat like an elongated oyster shell. The young lice hatch in spring about 1st of June, when they possess legs and are active for a few days only; at this time they are soft and unprotected. There is only one brood in the year. *Remedy:* Spray the trees during winter with lime wash (1 or 2 lbs. of fresh lime to a gallon of water), or, when the young scale-insects hatch, spray with kerosene emulsion (Formula I) or whale-oil soap (Formula III).

There are several other kinds of scale-insects which occur upon the apple, which may be treated in the same way as the Oyster-shell Bark-louse.

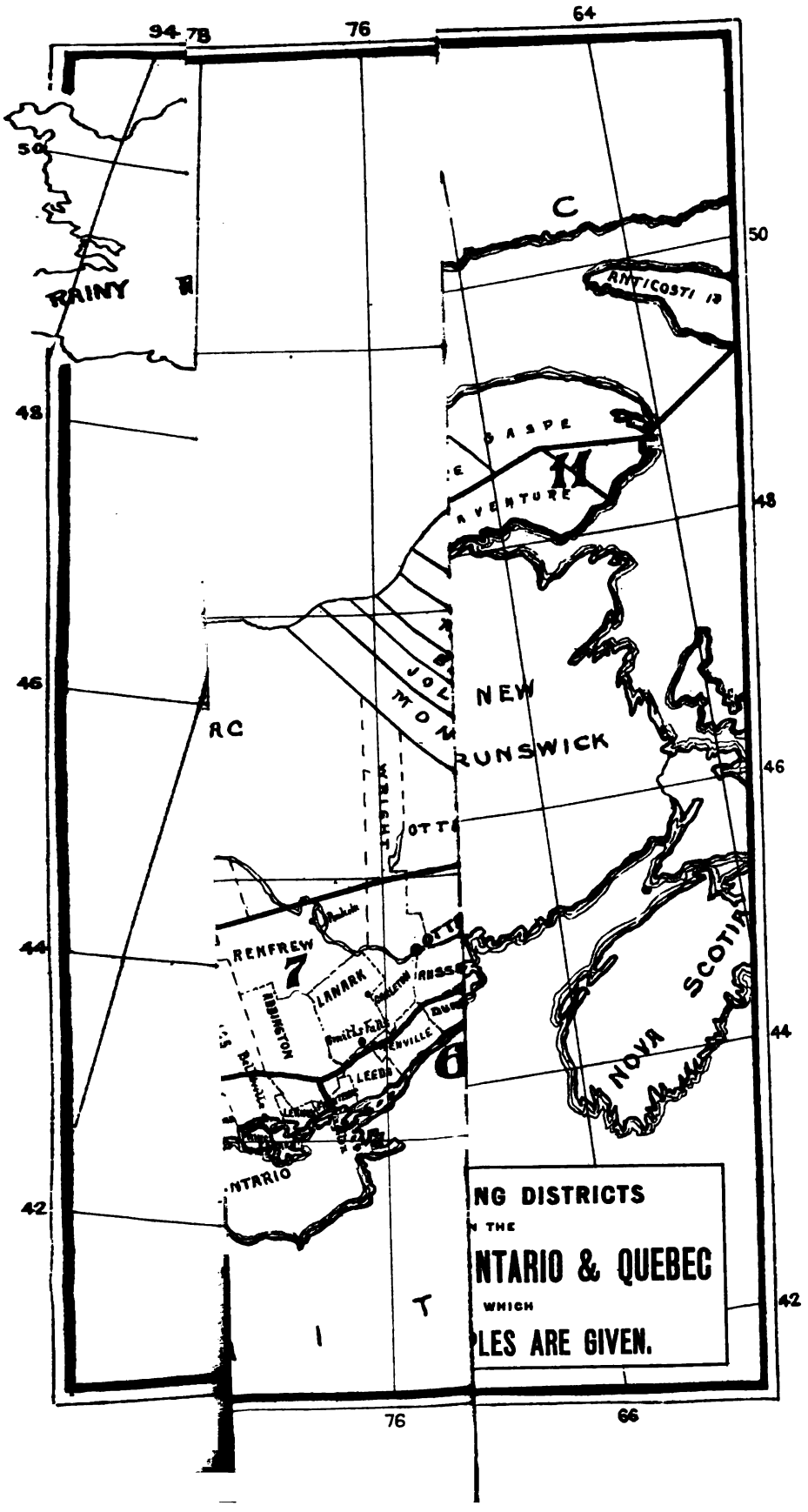
12. The Woolly Aphis (*Schizoneura lanigera*).—Clusters of white downy plant-lice, causing wart-like excrescences on the roots and stems or around wounds where a branch has been cut off. This insect is seldom a serious pest in the East, but is very troublesome in British Columbia. *Remedies*: Spray the colonies on the branches and trunks with kerosene emulsion or a wash made with 1 pound of concentrated lye and 1 pound of whale-oil soap in 5 gallons of water. For the root colonies, remove the surface soil to a depth of 6 inches, for a foot or two around the trunk and dig in tobacco dust or refuse from a tobacco factory.

ATTACKING THE FRUIT.

13. The Codling Moth (*Carpocapsa pomonella*).—This is the parent of the destructive Apple Worm so well known to all growers and consumers of apples all over the world. In Eastern Canada there is only one regular brood of the insect; west of Toronto there are two broods, the latter of which is by far the more destructive. Where there is only one brood, spraying with Paris green (Formula II or VI) three or four times in the spring, beginning immediately after the flowers have fallen, at intervals of ten days, is all that is required; where there are two broods, banding the trees in autumn with strips of burlap, whisps of hay, or one of the many contrivances known as "tree protectors," will be found necessary. The caterpillars resort to these shelters when ready to spin their cocoons and can be easily destroyed at any time before the following spring, when the moths would emerge.

Besides protecting apple trees from the attacks of the Codling Moth, spraying with the poisoned Bordeaux mixture (Formula VI), as advised above, will destroy many other enemies which feed on the foliage, such as Cankerworms, Tent Caterpillars, Leaf-rollers, &c.

The Apple Maggot (*Trypeta pomonella*).—Slender white footless maggots, ¼ of an inch in length, tapering gradually to the head and cut off abruptly behind, burrowing in all directions through the flesh of apples, feeding on the pulp and leaving brown channels. There are sometimes as many as a dozen maggots in a single apple. Infested fruit ripens prematurely and falls, when the maggots leave and, entering the soil a short distance, form puparia inside which they remain unchanged until the following spring. *Remedy*: Spraying is useless against this insect. The remedy most to be relied on is the prompt destruction of windfalls so as to prevent the maggots going into the ground. This can best be done by keeping a sufficient number of pigs, sheep or other stock in the orchard. The penning up of poultry beneath infested trees has been found a most useful practice.



94
78
76
64
50
48
46
44
42
66
RAINY
C
ANTICOSTI IS
GASPE
AVENTURE
11
NEW
RUNSWICK
RC
WRIGHT
OTT
RENFREW
7
LANARK
ABBINGTON
LEEDS
6
NOVA SCOTIA
NTARIO
I
T
NG DISTRICTS
N THE
NTARIO & QUEBEC
WHICH
LES ARE GIVEN.

.33
.E22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

SOFT PORK

AN

INVESTIGATION INTO ITS CHARACTER AND CAUSES

BY

FRANK T. SHUTT, M.A.

Chemist, Dominion Experimental Farms

BULLETIN No. 38

OCTOBER, 1901

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE.

To the Honourable
The Minister of Agriculture.

SIR,—I herewith submit for your approval Bulletin No. 38, of the Experimental Farm series, which has been prepared under my direction by Mr. F. T. Shutt, chemist of the Dominion Experimental Farms, in which is given the results of a series of investigations into the character and causes of soft pork.

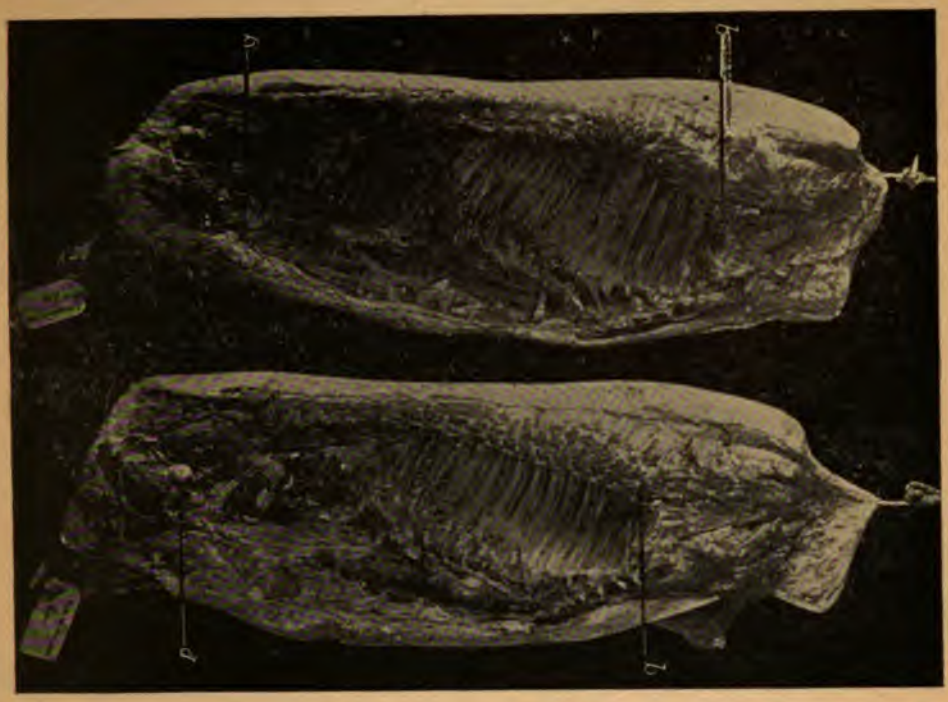
This subject is a most important one, bearing as it does on a profitable and rapidly growing branch of farm industry, one which can be carried on with advantage in nearly all the settled parts of the Dominion. From the results presented in this bulletin, it will be seen that much light has been thrown on this difficult subject, and that by persistent chemical research, based on the results obtained from the feeding of a variety of rations, the causes and conditions by which softness in the fat of pork is brought about are satisfactorily shown.

It is hoped that the information contained in this bulletin will be of much practical value to all who are engaged in the pork industry and that it will lead to greater uniformity of character and an average higher quality in Canadian bacon and stimulate further progress in this division of farm work.

I have the honour to be,
Your obedient servant,

WM. SAUNDERS,
Director Experimental Farms.

OTTAWA, October 15, 1901.



FIRM AND SOFT SIDES OF PORK.

A B

GROUP OF PIGS FED ON (A) CORN MEAL AND SKIM-MILK; AND (B) CORN MEAL ONLY.

SOFT PORK.

AN INVESTIGATION INTO ITS CHARACTER AND CAUSES *

BY

FRANK T. SHUTT, M.A., F.C.S.,

Chemist, Dominion Experimental Farms.

INTRODUCTION.

That the export bacon trade is one of great importance to Canada is obvious from the fact that last year we received from England more than $12,000,000 for this commodity alone. Moreover, the limit has not yet been reached ; those engaged in the packing business assure us that the demand for first-class Canadian bacon will continue to increase for some years to come. It is, therefore, advisable that our farmers and dairymen should well understand the requirements of this large and remunerative market as regards size, shape, fatness and, above all, the character or quality of the bacon. These are matters which closely concern the raiser of pigs, for they are not under the control of the packer. Further, it is well to remember that the highest price will only be paid in England for that article which conforms with the demands of the consuming public, and that it is only first-class bacon that can be exported with profit.

Among the qualities necessary for first-class bacon in England, none is of greater importance than firmness. A tendency to softness or tenderness is quite sufficient to rate the bacon at second-class prices, and, if this softness is at all pronounced, to make it altogether unsaleable at a profit.

Since it was reported by our packers that a large, though varying, proportion of the pigs offered them produced soft bacon, and that this detrimental character specially characterized the produce of pigs from certain districts, it was held that an investigation to learn the nature and the cause or causes of 'soft' pork would, in all probability, furnish information of a most useful and valuable character.

*The feeding trials which this investigation necessitated were planned and conducted by Mr. J. H. Grisdale, Agriculturist, Central Experimental Farm. In addition to this most important part of the work, Mr. Grisdale, by his advice and assistance in the factory inspection and rating of the animals, has rendered most valuable aid, and I am much indebted to him for his hearty co-operation in bringing this research to a successful issue.

THE NATURE OF 'SOFTNESS.'

Naturally, the first step in undertaking the solution of this difficult problem was to ascertain the difference in composition of 'firm' and 'soft' pork, so that chemical analysis might be employed as an accurate discriminating agent in the examination of pork produced under varying conditions of food, exercise, &c., and that we might obtain standards that could serve as a basis for future work and comparison. Accordingly, we procured (February 1, 1899) from The Wm. Davies Co., Limited, Toronto, two (salted) Wiltshire sides, the one marked 'firm' and reported as of excellent quality ; the other marked 'soft,' and stated as of very inferior quality. The former weighed 46 pounds ; the latter, 44 pounds.

Both were frozen when received, but, nevertheless, there was a marked difference in the relative hardness of the two sides. As the sides thawed (at the temperature of the laboratory, about 70°F.) this difference—which was ascertained or measured by the resistance of the fatty portions to pressure by the finger—became still more pronounced. This was further evinced (February 2) in raising the ham by lifting as the sides lay on the table; the 'firm' remained fairly straight, whereas, the 'soft' doubled over. The relative softness is also shown in the accompanying photograph, the sides having been suspended the night previous. It illustrates the amount of 'drag' caused by the weight of the sides, similarly suspended by hooks. The extent of the 'drag' in the 'soft' side is much the greater.

The samples of the fat for examination were obtained by first cutting the sides (*a*) immediately in front of the thigh joint (socket of the femur in the pelvic arch), and (*b*) immediately in front of the first rib, and then taking the fatty tissue at each of these sections. Those taken at (*a*) are designated in the following tables as 'Loin'; those at (*b*) as 'Shoulder' (see photo). The precaution of confining the place or area from which the fat was taken was considered advisable from the fact that it has been stated that the fat varies considerably in composition, according to its position in the animal. Care was exercised in the preparation of the sample for analysis, to dissect out and reject all muscular tissue, blood vessels, &c.

The principal data obtained in this examination are presented in the following tables. Table I contains the percentages of the various constituents determined, in the fatty tissue of the two bacons :—

TABLE I.—Composition of Fatty Tissue in 'Firm' and 'Soft' Bacon.

—	Firm.		Soft.	
	Loin.	Shoulder.	Loin.	Shoulder.
	p. c.	p. c.	p. c.	p. c.
Water	15·56	6·53	12·50	2·67
Salt	2·73	1·12	1·84	·48
Nitrogen	·504	·285	·243	·142
Fibre (nitrogenous tissue)	3·15	1·78	1·52	·89
Fat	78·56	90·57	84·27	95·96
Olein in bacon	50·05	58·33	66·37	76·94
Palmitin and stearin in bacon	28·51	52·24	17·90	19·02

The fat proper consists essentially of olein, fluid at ordinary temperatures, and palmitin and stearin, solid at ordinary temperatures. It was hence conjectured that the percentage of olein would be found to be greater in the fat of the 'soft' than that

of the 'firm' pork.* Accordingly, the olein in the dry, filtered fat was estimated, and it is from the figures so obtained that the percentages of olein and palmitin and stearin in the bacon, given above, were calculated. The detailed analyses of the pure fats and the ratio of the olein to palmitin and stearin contained therein are given in table II.

TABLE II.—Composition of Fat from 'Firm' and 'Soft' Bacon.

	Firm.		Soft.	
	Loin.	Shoulder.	Loin.	Shoulder.
	p. c.	p. c.	p. c.	p. c.
Olein (calculated)	63·71	64·40	79·95	80·18
Palmitin and stearin	36·29	35·60	20 05	19·82
Ratio of palmitin and stearin to olein	1 : 1·76	1 : 1·80	1 : 3·99	1 : 4·02

These figures show very clearly that the fat of the 'soft' bacon contains a much larger proportion of olein than that of the 'firm' bacon, accompanied necessarily by a correspondingly decreased proportion of the solid fats, palmitin and stearin. We have in this fact—the large percentage of olein—the explanation of the peculiar and characteristic flabbiness of 'soft' pork. We also have afforded us in this discovery, through the estimation of olein, a ready means of tracing the effect of any particular food or condition on the pork produced.

Table III sets forth certain determinations made on the pure, filtered fat. Though of a strictly scientific character, they are of considerable importance, since they allow us to make deductions easily understood and of a practical character regarding the nature of the fats.

TABLE III.—Physical and Chemical Constants of Fat from 'Firm' and 'Soft' Bacon.

	Firm.		Soft.	
	Loin.	Shoulder.	Loin.	Shoulder.
	p. c.	p. c.	p. c.	p. c.
Melting point	37·6° C.	37·75° C.	27·4° C.	28·2° C.
Specific gravity at 96° C	·8668	·8859	·8678	·8740
" " 100° F	·9009	·8980	·8970	·8988
Sapon. equivalent	285·3	282·3	287·3	286·0
Reichert number	·408	·714	·408	·663
Iodine absorbed	55·3	55·9	69·4	69·6

*In addition to olein, no doubt a certain proportion of linolein—also a fluid fat—occurs in the fat of soft pork, and especially in that produced from corn. It will be seen from the present investigation that not only is there a close relationship between the consistency of a fat and its composition, but also that the food has a marked effect upon that composition, and hence upon its consistency or relative firmness. The oil of corn possesses more or less of this fluid fat linolein, which finds its way in part through the animal economy into the body fat. In the method of analysis employed, advantage was taken of the fact that these fluid fats are unsaturated and combine with iodine, and in this respect differ from plamitin and stearin, the solid fats. From the amount of iodine so absorbed, the fluid fat present was calculated, which, for the sake of simplicity, has been recorded in this bulletin as olein. Wherever the term olein is used, it is intended to include all fluid fats present.

No purpose will be served by discussing in detail the above data in this bulletin ; but the fact may be emphasized that they indicate the olein content and melting point, and especially the former, as data of great diagnostic value in this research. Indeed, to such a degree has subsequent work shown this to be the case that, although many other determinations, *e.g.*, nitrogen, non-fatty tissue, &c., were made on the larger number of pigs, we shall only present the figures for the olein and melting point estimations. We feel convinced that these data are reliable and in themselves sufficient to be used exclusively in pronouncing a judgment upon the relative firmness of the pork under investigation.

IMMATURE OR 'UNRIPE' PORK.

After the completion of the foregoing work and at the outset of the investigation about to be described, four very young pigs were examined in order to learn the nature of the fat of immature animals. Of these, two were from Western Ontario and two from Eastern Ontario. These pigs were slaughtered at the Geo. Matthews Co. Packing House, Hull, Que., June 27, and examined June 28, 1899. We adjudged Nos. 57 and 58 as decidedly soft, and Nos. 59 and 60 as only moderately firm.

An independent examination was made by Mr. W. E. Matthews, some two days later. His report is as follows :—'We have looked the little pigs over and think they are almost too small to secure anything definite from, but we find that Nos. 59 and 60 are by far the firmer pigs, No. 57 being a little soft, and No. 58 the softest of the lot. Not knowing where the pigs came from, we express the opinion that they are from what we would call a 'corn section,' as the fat on all shows signs of oil.'

It is to be noticed that this expert adjudged all the pigs soft (though varying in degree of softness), but considered them too small to draw definite conclusions from. It will now be shown that the laboratory data bear out in a marked manner Mr. Matthews's judgment. As already stated, only the data respecting the olein and melting point will be considered here, the other results being of minor importance for the purposes of this investigation.

TABLE IV.—Immature Pork ; Composition and Melting point.

No. of Pig.	Locality.	Dressed Weight.	Olein.		Ratio of Palmitin and Stearin to Olein.		Melting Point.	
			Shoulder.	Loin.	Shoulder.	Loin.	Shoulder.	Loin.
		Lbs.	p. c.	p. c.	p. c.	p. c.		
57	West.....	27	90·6	88·2	1 : 9·6	1 : 7·5	25·2° C.	24·4° C.
58	"	23	86·9	85·9	1 : 6·5	1 : 6·1	24·5° C.	25·7° C.
59	East..... ..	42	83·3	82·2	1 : 4·9	1 : 4·6	27·6° C.	28·5° C.
60	"	30	73·3	72·9	1 : 2·7	1 : 2·7	29·8° C.	32·0° C.

These pigs when killed had been recently weaned, hence the results furnish us with no information regarding the effect of feed ; it is significant, however, that the two softest were obtained from a so-called 'corn section' in Western Ontario.

If the above data are compared with those of table II. it will be observed that in all the fats the percentage of olein is considerably greater than that in the fat obtained from the 'firm' supplied by The Davies Co. Exceedingly instructive also is a comparison of the ratio of palmitin and stearin to olein. Thus, in the fat of the 'firm' pork of The Davies Co. we obtained 1 : 1·76 ; the ratio for the fat of the same part of the pig No. 60 (the firmest of the four) was 1 : 2·69.

It seems probable that the fat of all young pigs contains a large amount of olein, and is consequently more or less soft. From this and subsequent work we are inclined to think that age and maturity or ripeness are factors of importance towards a 'firm' fat. In discussing the various rations used in this investigation, we shall place in each table the results obtained from certain immature or 'unripe' pigs (killed at about 100 lbs. live weight) taken from each pen, and it will be seen that the fat of these aniamls invariably possesses a larger percentage of olein than that of the remainder of the pigs on the same ration, which were not slaughtered until they had reached a live weight of 180 to 200 lbs.

STANDARDS OF FIRMNESS.

We are not as yet, perhaps, in a position to establish standards of firmness, that is, to say exactly what percentage of olein is to be considered as the limit for pork technically known as 'firm'; but for the purpose of comparing the various results here presented we shall be obliged to adopt provisional limits. These have been decided upon since the completion of the investigation, which has been in progress for the past two and a half years, from the chemical results and the ratings made at the packing house. In connection with the latter data, it should be stated that each dressed pig, after being thoroughly chilled, was critically examined at the packing house. In this investigation we adopted a scale of firmness ranging from 100 downwards. The cut surface of the fat along the back was felt and rubbed with the fingers, and that which was hardest and most resistant to pressure, rated at 100. The softest examined was placed at 20. Oiliness was also specially noted, and it is of interest to know there were but few cases in which the softness (slight resistance to pressure) was not accompanied by this quality. Thickness of fat, shape of carcase, &c., were also remarked.

It is to be pointed out as the result of our experience, that such an inspection, even when made by an expert, cannot furnish figures that will so closely differentiate as to relative softness as do the percentages of olein. In fact, in order to obtain comparative ratings, even of a fairly accurate character, it is essential that the carcases should remain at least forty-eight hours after slaughtering in a refrigerating room of uniform temperature before inspection.

During several months of the winter, artificial refrigeration to chill the carcases in the packing house is unnecessary at Ottawa, and it was noted not unfrequently that the temperatures to which the carcases were exposed during these periods fell to many degrees below zero. As a natural result many of our ratings for individual pigs in the winter are too high. On the other hand, we have found that if owing to any cause the temperature of the refrigerating room in summer is allowed to rise, the ratings are too low.

For these and other obvious reasons, we believe that the olein content furnishes by far the more reliable indication of relative firmness; we are of the opinion that unless the very greatest care and judgment be exercised, the rating from inspection at the packing house is in a matter of close discrimination of little save corroborative value. It is for this reason that in the presentation of the subject we have arranged the ratings in the charts or tables according to percentages of olein rather than by the factory values. Further, to avoid as far as possible the introduction of error arising from such differences of temperature as we have alluded to, we have adopted certain terms and affixed values thereto, as indicated on the following page :—

FACTORY OR INSPECTION RATINGS.*

Very firm	from	85	to	100	points.
Firm	"	75	"	85	"
Moderately firm	"	70	"	75	"
Soft	"	50	"	70	"
Very soft	Less than			50	"

The percentages of olein corresponding to the above classification we find to be approximately as follows :—

	Percentage of Olein.
Very firm	68 and less.
Firm	between 68 and 71
Moderately firm	" 71 " 73
Soft	" 73 " 75
Very soft	" 75 " above.

THEORIES REGARDING THE CAUSE OF 'SOFTNESS.'

Many theories have been advanced to account for softness in pork. Some have ascribed it to the character of the food, others to undue forcing of the pig in the earlier stages of growth, to killing the pig while in 'heat' or slaughtering while still immature or unripe, to the breed of the pig, to the locality or district in which the pig is grown, and even the phase of the moon when the pig is slaughtered has been assigned as a cause.

SCHEME AND OBJECTS OF THE INVESTIGATION.

On the completion of the preparatory work already recorded, the first series of feeding trials was instituted upon the Central Experimental Farm, Ottawa, followed by a laboratory examination of the pork produced. There were in all about one hundred and eighty pigs, and the experiment was commenced in the month of May, 1899, when the majority of them were between one and two months old.

They were either Tamworths or Tamworth grades.

The scheme of the trial was such that information would be gained as to the effect upon the quality of the pork of the following possible factors :—

1. Character of food (*a*) fed throughout life, and (*b*) fed during the initial and finishing periods, respectively.
2. Limited and unlimited supply of food.
3. Soaked or cooked grain as against dry or uncooked grain.
4. Age of animal when slaughtered.
5. Exercise and lack of exercise.
6. Locality or district where raised.

Details of the above may be briefly ascribed as follows :—

1. The character of the various foods used, together with particulars regarding its supply and treatment (*vide* 1, 2, and 3 above) are shown in the following scheme :—

---

*The pigs of both 1st and 2nd series were slaughtered and dressed at the packing house of The Geo. Matthews Co., Ltd., Hull, Que., where the inspection ratings were made. We are indebted to the Messrs. Matthews for much valuable advice and assistance in the grading of the carcases.

RATIONS : FIRST SERIES OF FEEDING TRIALS, 1899.

A.....½ oats, pease and barley (in equal parts).....
B.....½ oats, pease and barley (in equal parts)..... } Boiled.
Limited and unlimited.

B.....½ oats, pease and barley (in equal parts).....
½ corn meal..... } Dry.
Limited and unlimited.

C.....Corn meal exclusively..... Dry.
Unlimited.

D.....Oats, pease and barley (in equal parts)..... Dry.
Unlimited.

E.....Corn meal exclusively.....Soaked.
Unlimited.

F.....Oats, pease and barley (in equal parts) ..... Soaked.
Unlimited.

G.....Beans, 1 part .....
Shorts, ¾ part ..... } Boiled.

H.....First Period—½ corn meal .....
½ oats, pease and barley (in equal parts) ..... } Boiled.
Second Period—Corn meal ..... Boiled.

I.....First Period—½ corn meal.
½ oats, pease and barley (in equal parts) ..... Dry.
Second Period—Corn meal ..... Dry.

J.....First Period—Corn meal ..... Dry.
Second Period—Oats, pease and barley (in equal parts) ..... Dry.

K.....First Period—Oats, pease and barley (in equal parts)..... Dry.
Second Period—Corn meal ..... Dry.

L.....First Period—Corn meal..... Soaked.
Second Period—Oats, pease and barley (in equal parts)..... Soaked.

M.....First Period—Oats, pease and barley (in equal parts)..... Soaked.
Second Period—Corn meal..... Soaked.

N.....½ corn meal.
½ oats, pease and barley (in equal parts).

O.....½ corn meal.
½ oats, pease and barley (in equal parts).
Mangels.

P.....½ corn meal.
½ oats, pease and barley (in equal parts).
Pastured on clover.

In pens H, I, J, K, L, M, it will be noticed that two rations were used; the first was fed until the pigs reached a live weight of 100 pounds, the second, from that weight until the pigs were finished. This method allowed us to ascertain the effect on the quality of the pork of the various rations at different periods of growth.

Where not otherwise stated, a sufficiency of green fodder, usually pease and oats, in addition to the grain ration was given to keep the animals in a thrifty condition.

2. As regards the supply of food, the pigs in one pen on each ration were given all they would eat, and this has been termed 'unlimited'; the pigs in the duplicate pen were fed with that quantity only that was thought necessary for normal growth; and this has been given in the tables as 'limited.'

It is very doubtful, however, if in experiments conducted with several pigs in a pen this classification is of any value, for we have found that, no matter what the supply may be, the larger animals practically get an unlimited quantity, while the smaller ones are sometimes on an extremely limited ration. We have accordingly grouped together in the tables of data the pigs on the 'limited' and 'unlimited' supplies of the same ration.

3. In two experiments, cooked as against a dry grain mixture was tried; in four cases, the effect of soaked as against dry grain was ascertained.

4. To ascertain what effect lack of maturity might have, two pigs from each pen were examined when they had reached the live weight of 100 pounds; the remainder were fed until they attained a live weight between 175 and 200 pounds.

5. To ascertain the result of exercise on the production of firm pork, an equal number of animals on each ration was placed (*a*) in small paddocks containing shanties or shelters, and, (*b*) in a pen of the piggery, each pen having a small yard attached. The pigs in the former are assumed to have had unlimited exercise, and are designated in the tables as 'outside' while those in the piggery are considered to have had limited exercise only. These latter are placed under the heading 'inside.'

6. Each pen, as a rule, consisted of sixteen pigs, eight of which had been obtained in Western Ontario (Essex and Kent counties) and eight in Eastern Ontario (Carleton County). This feature was adopted at the request of certain packers, who considered eastern bred pigs of better quality.

To render this account more concise, and consequently easier of comprehension, we purpose placing the detailed data in tabular form together at the end of the bulletin, simply discussing here the averages obtained from each pen. These data, although, as stated, are somewhat in detail, represent only a part of the estimations made. All the determinations which do not apparently throw any light on the object of this investigation have been omitted, for the reason that they might confuse the reader. On the same ground, the pigs on 'limited' and 'unlimited' rations are classed together and the averages of the results of the 'shoulder' and 'loin' fats are also given, the differences being too small to merit in this bulletin detailed discussion.

GENERAL RESULTS FROM FINISHED PIGS. FIRST SERIES, 1899.

In order to obtain at a glance the relative merits of the various rations in the production of firm pork, a table showing the average percentage of olein and the average melting point of each pen will be first presented. In this table the rations are arranged from above downwards in the order of 'firmness,' as indicated by the olein; that is, the ration giving least olein is placed at the head, and that producing most olein, at the bottom of the chart. We shall then discuss briefly these results and proceed to analyse more closely each ration separately, giving in chart form the figures for the olein content of the fat of the pigs obtained from the east and west respectively, and of those raised with and without exercise. In the appendix we shall place tables giving further details from each pen of pigs. These should be referred to in order to observe the effect of individuality among the animals similarly fed under the same conditions.

TABLE V.—AVERAGES from determination of 1st Series, 1899.

Ration.	Composition of Ration.	Olein.	Melting Point.
F	Oats, pease and barley, ⅓ each, soaked, unlimited	67·2	35·6
D	" " " dry, unlimited	67·5	34·2
B	½ corn meal; ½ oats, pease and barley, ⅓ each, dry, unlimited	71·1	34·4
A	" " " boiled, unlimited	72·7	33·6
B¹	" " " dry, limited	73·1	33·1
M	1st Period: Oats, pease and barley, ⅓ each, soaked. 2nd Period: Corn meal, soaked	73·4	32·5
N	½ corn meal; ½ oats, pease and barley, ⅓ each, dry, limited	73·7	30·5
K	1st Period: Oats, pease and barley, ⅓ each, unlimited. 2nd Period: Corn meal, dry, unlimited	74·3	32·4
O	½ corn meal; ½ oats, pease and barley, ⅓ each, mangels	74·9	31·7
I	1st Period: ½ corn meal; ½ oats, pease and barley, ⅓ each, dry, unlimited. 2nd Period: Corn meal, dry	75·4	32·4
A¹	½ corn meal; ½ oats, pease and barley, ⅓ each, boiled, limited	75·9	33·6
P	½ corn meal; ½ oats, pease and barley, ⅓ each, steamed clover	76·1	32·1
L	1st Period: Corn meal, soaked. 2nd Period: Oats, pease and barley, ⅓ each, soaked	76·4	32·3
I¹	1st Period: ½ corn meal; ½ oats, pease and barley, ⅓ each, dry, limited. 2nd Period: Corn meal, dry, limited	78·1	31·8
H	1st Period: ½ corn meal; ½ oats, pease and barley, ⅓ each, boiled, unlimited. 2nd Period: Corn meal, boiled, unlimited	77·9	33·0
J	1st Period: Corn meal, dry, unlimited. 2nd Period: Oats, pease and barley, ⅓ each, dry, unlimited	78·8	31·3
H¹	1st Period: ½ corn meal; ½ oats, pease and barley, ⅓ each, boiled, limited. 2nd Period: Corn meal, boiled, limited	80·0	30·2
G	Beans 1 part, shorts ¾ part	84·7	31·0
C	Corn meal, dry, unlimited	92·0	30·9*
E	Corn meal, soaked, unlimited	92·4	27·7

The more important inferences to be drawn from these data may be briefly stated as follow :—

1. That of all the grain rations employed, that consisting of equal parts of oats, pease and barley gave the firmest pork. It may further be added that the fat was deposited evenly and not too thickly, and that this ration gave a very thrifty growth.

2. That no difference could be observed in the firmness of the pork from the preceding ration whether fed soaked or dry.

3. That when half the grain ration (as in A and B) consists of corn meal, the resulting pork shows an increased percentage of olein; in other words, a tendency to softness.

* Melting point average on two pigs only, as the fat of the others was so soft that the melting point could not be determined.

4. That in this ration (half corn meal, half oats, pease and barley in equal parts) the feeding of it boiled gave a slightly higher olein content, but this is only apparent when the average from the four pens is taken into consideration.

5. That considering the effect of feeding the ration of oats, pease and barley during the first period (to a live weight of 100 pounds) and corn meal during the finishing period, compared with the reverse of this plan—that is, corn first, followed with oats, pease and barley—we may conclude that the former gives a firmer pork.

6. That in both methods mentioned in the preceding paragraph, no marked difference was to be observed from the ration fed dry or previously soaked, though taking an average of the two groups on each ration the 'dry' feed gave a somewhat higher olein content.

7. That when as in rations I and H, corn meal formed half the first period ration, and the whole of the second period ration, the resulting pork was somewhat softer than from that of any of the rations already discussed. We conclude that the longer the period during which the corn is fed as a large proportion of the ration, the softer will be the pork.

8. That beans produce a soft and inferior pork. The growth of the pigs so fed was poor and miserable and the deposition of the fat meagre. (See illustration.)

9. That corn meal fed exclusively as the grain ration, either dry or previously soaked, results in an extremely soft fat, the percentage of olein being considerably higher than from any other ration tested. The pork was of an inferior quality. Here also we noted the miserable growth of the animals, the ration in no sense being an economical one. *

GENERAL RESULTS FROM IMMATURE PIGS, 1899.

Similar data for the immature (100 pounds live weight) pigs are presented in Table VI. It will be noticed that save in the case of the oats, pease and barley ration, the percentages of olein are very high, denoting an extremely soft pork.

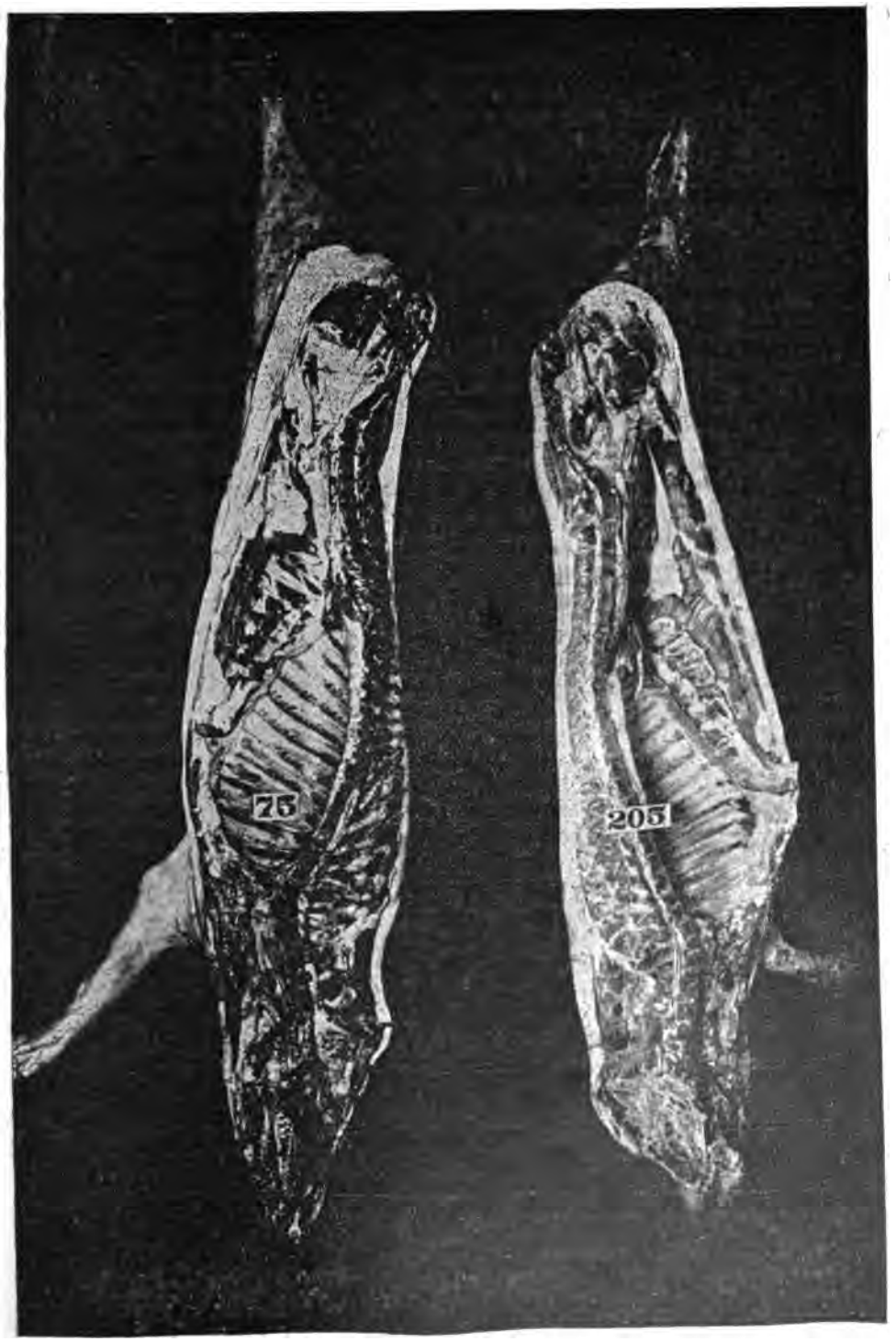
TABLE VI.—AVERAGE PERCENTAGE of Olein in Fat of Immature Pigs.

Ration.	East.	West.	Mean.
Ration A.—½ corn meal; ½ oats, pease and barley, ⅓ each, boiled, unlimited....	†77·1	†91 6	84·3
" " " " limited.....	79·2	.....	.....
" B.—½ corn meal; ½ oats, pease and barley, ⅓ each, dry, unlimited.....	83·0	*87·1	85·0
" " " " limited.....	75·0	83·5	79·3
" C.—Corn meal, dry, unlimited.....	87·2	85·6	86·4
" D.—Oats, pease and barley, ⅓ each, dry, unlimited.....	80·9	83·6	82·1
" E.—Corn meal, soaked, unlimited.....	85·7	88·4	87·0
" F.—Oats, pease and barley, ⅓ each, soaked, unlimited.....	71·9	77·0	74·4
" G.—Beans 1 part, shorts ¾ part.....	†83·9	.....	.....

These results are confirmatory of those already quoted from our experiments made at the outset of the inquiry (see page 10), and furnish, in our opinion, un-

*In any consideration of the foregoing conclusions, it should be borne in mind that they are based upon averages obtained from a large number of determinations, each figure of Table V. being the mean of estimations from twelve to sixteen examinations. As will be seen as we proceed in the inquiry, considerable differences exist between individuals under the same conditions and on the same food, differences that are probably due in part to what we may term lack of thrift, in part to immaturity or unripeness, and in part to causes yet undiscovered. It is advisable for the reader, therefore, to study the tables that follow and the explanatory text that accompanies them. In this way only can a correct impression be gained as to the varying results obtained in this investigation and their practical bearing on pig feeding.

† One pig only.



No. 75.—Indian corn

No. 205.—Beans

doubted proof of the 'soft' character of the fat of young pigs. Though all show a very large percentage of olein, the proportion of this constituent present varies with the character of the ration. The order of softness is practically identical with that found for the mature pigs, though that order has not been adopted in tabulating the results.

DETAILED DATA FROM THE GROUPS OF FIRST SERIES, 1899.

In the following tables we have given the results of the different rations fed under the varying conditions already enumerated, placing the figures side by side. We have, however, averaged the estimations from pigs under a limited and unlimited food supply, feeling assured that this distinction in pens containing a large number of pigs had little or no value. The data, therefore, set forth are the percentages of olein from the rations fed soaked or boiled and dry to eastern and western pigs, respectively, under conditions of limited and practically unlimited exercise, the latter being denoted in the tables as 'inside' and 'outside' respectively.

When comparing the rating by olein with those from inspection, it should be remembered that the former are averages from two or more animals, that may or may not differ materially, while the latter are from individuals. The ratings, therefore, are not strictly comparable. Further, owing to the fact that it was impossible to inspect and grade all the pigs at the same temperature, the inspection ratings cannot be considered so accurate an indication of relative firmness as the olein content, nor can it be expected, for the same reason, that this factory rating will always agree with the classification from the laboratory data.

RATION A AND B—ONE-HALF CORN MEAL; ONE-HALF OATS, PEASE AND BARLEY, IN EQUAL PARTS.

Considering first the finished pigs, we may bring together the olein content as follows :—

	Per cent Olein.
Boiled grain	74·3
Dry grain	72·1
Eastern pigs	73·4
Western pigs	73·0
Inside	71·9
Outside	74·5
Average of all	73·2

In connection with these data it will be instructive to note the ratings as to firmness obtained at the packing house :—

	V.F.	F.	M.F.	S.	V.S.
Boiled grain	..	2	2	9	3
Dry grain	1	1	1	11	2
Eastern pigs	..	2	2	11	1
Western pigs	1	1	1	9	4

The olein values place the majority of these pigs on the border line between 'moderately firm' and 'soft'; the inspection ratings adjudge twenty of the thirty-two animals as soft. It would seem, therefore, that when corn to the extent of half the ration is continued throughout life, and no corrective, as skim milk, is employed, the tendency will be towards the production of a soft or oily fat. In a number of the pigs the fat along the back was too thick and of uneven deposition.

The immature pigs of A and B (distinguished in the table by a dressed weight of less than 100 pounds) gave the following olein values :—

Boiled grain	82·7
Dry grain	81·7
Eastern pigs	78·6
Western pigs	86·7
Inside	83·6
Outside	80·1

The inspection ratings are as follow :—

	S.	V.S.
Eastern pigs	3	4
Western "	2	2

It is seen from these results that although the ration consisted of one-half of corn meal throughout the whole feeding period, the quality of the pork improved as the pigs reached maturity.

TABLE VII.

RATION A and B.—One-half Corn Meal ; one-half Oats, Pease and Barley.

No. of Pigs.	Dressed Weight.	Percentage of Olein.							
		Boiled.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
	Lbs.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
1	67	77·2	.....	.....	.....	.....	.....	.....	.....
2	64	.....	.....	79·2	.....	.....	.....	.....	.....
1	66	.....	91·6	.....	.....	.....	.....	.....	.....
4	127	73·0	.....	.....	.....	.....	.....	.....	.....
4	136	.....	.....	75.6	.....	.....	.....	.....	.....
4	125	.....	73·6	.....	.....	.....	.....	.....	.....
4	121	.....	.....	.....	75·0	.....	.....	.....	.....
2	76	.....	.....	.....	.....	80·3	.....	.....	.....
2	65	.....	.....	.....	.....	.....	.....	77.8	.....
2	67	.....	.....	.....	.....	.....	85.4	.....	.....
1	69	.....	.....	.....	.....	.....	.....	.....	83·2
4	140	.....	.....	.....	.....	70·5	.....	.....	.....
4	139	.....	.....	.....	.....	.....	.....	74·5	.....
4	133	.....	.....	.....	.....	.....	70·6	.....	.....
4	137	.....	.....	.....	.....	.....	.....	.....	72·9

RATION C AND E.—CORN MEAL EXCLUSIVELY.

The results from four pens fed upon corn meal only are given in Table VIII. The pigs with corn meal soaked and dry made very poor growth, very few of them reaching 100 pounds live weight before December (seven months) and several scarcely arriving at that weight by the following April, when the pigs would be eleven or twelve months old. Of the twenty-four animals in the two pens only five had exceeded 170 pounds live weight when the experiment was closed, May 28. Undoubtedly this lack of thrift is in a large measure due to the small proportion of nitrogenous or flesh-forming substances present in corn. Bone-forming material (mineral matter) is also deficient in this grain, and this fact no doubt still further accentuates its unsuitability when used alone, for young and growing stock.

As regards olein, the results show that the fat of all the pigs contain a very high percentage; the so-called finished pigs, in this instance, giving the larger figures. The data of each group are strikingly uniform, as will be noticed from the following tabulation :—

Finished Pigs.

	Per cent of Olein.
Soaked grain	92·5
Dry grain	92·1
Eastern pigs	91·2
Western pigs	93·4
Inside	92·3
Outside	92·3
Average of all	92·3

Immature Pigs.

Soaked grain	87·1
Dry grain	86·4
Eastern pigs	86·5
Western pigs	87·0
Inside	87·6
Outside	85·9
Average of all	86·8

By the olein standard, all fall into the class of 'very soft.' In many instances the melting point could not be taken owing to the fluidity of the fat.

Inspection at the packing house gave the rating of twenty-three very soft and one soft. In a large number of pigs the deposition of the fat was very meagre in amount and exceedingly soft in character, and the carcases showed marked evidences of stunted or retarded growth. In every particular, corn meal as the exclusive grain showed itself unsuitable and unsatisfactory.

TABLE VIII.

Ration C and E.—Corn Meal.

No. of Pigs.	Dressed Weight.	Percentage of Olein.							
		Soaked.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
	Lbs.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
1	78	87·1	.....	.....	.....	.....	.....	.....	.....
1	83	.....	.....	84·5	.....	.....	.....	.....	.....
1	63	.....	84·2	.....	.....	.....	.....	.....	.....
1	71	.....	.....	.....	92·6	.....	.....	.....	.....
2	93	92·1	.....	.....	.....	.....	.....	.....	.....
2	93	.....	.....	92·3	.....	.....	.....	.....	.....
2	98	.....	93·6	.....	.....	.....	.....	.....	.....
2	110	.....	.....	.....	91·9	.....	.....	.....	.....
1	65	.....	.....	.....	.....	90.9	.....	.....	.....
1	69	.....	.....	.....	.....	.....	.....	83·6	.....
1	76	.....	.....	.....	.....	.....	88·3	.....	.....
1	72	.....	.....	.....	.....	.....	.....	.....	82·9
2	90	.....	.....	.....	.....	87·9	.....	.....	.....
2	83	.....	.....	.....	.....	.....	.....	92·7	.....
2	88	.....	.....	.....	.....	.....	95·5	.....	.....
1	100	.....	.....	.....	.....	.....	.....	.....	92·4

RATIONS D AND F.—OATS, PEASE AND BARLEY IN EQUAL PARTS.

The percentages of olein of the twenty-four animals fed with the above ration will now be discussed. These pigs furnished the finest quality of pork of all those under experiment; the fat, for the most part, was exceedingly firm and even in thickness, about one and one-quarter inches in the finished animal. Growth was continuous and normal.

Notwithstanding the varying conditions of the trial, all the pigs on this most satisfactory ration gave a uniformly low olein content :

Finished Pigs.

	Percentage of Olein.
Soaked grain	67·2
Dry grain	67·7
Eastern pigs	67·9
Western pigs	67·0
Inside	67·0
Outside	67·9

The average, 67·5 per cent, places these pigs in the 'very firm' class.

The inspection ratings are as follow :—

	V.F	F.	M.F.	S.	V.S.
Soaked grain	3	3	1	1	..
Dry grain	1	4	1	2	..
Eastern pigs	3	1	..	3	..
Western pigs	1	6	1	..	..

The immature pigs, as might be inferred from what has already been stated, gave a softer fat. The averages are subjoined :—

Immature Pigs.

	Percentage of Olein.
Soaked grain	74·5
Dry grain	81·8
Eastern pigs	76·4
Western pigs	79·2
Inside	82·6
Outside	70·9

Their inspection ratings are as follow :—

	V.F	F.	M.F.	S.	V.S.
Soaked grain	..	2	..	..	1
Dry grain	..	..	..	..	3
Eastern pigs	..	1	..	1	2
Western pigs	..	1	..	1	1

TABLE IX.

RATION D and F.—Oats, Pease and Barley, one-third each.

No. of Pigs.	Dressed Weight.	Percentage of Olein.							
		Soaked.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
	Lbs.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
1	71	76·7	.....	.....	.....	.....	.....	.....	.....
1	60	.....	.....	67·2	.....	.....	.....	.....	.....
1	65	.....	84·6	.....	.....	.....	.....	.....	.....
1	67	.....	.....	.....	69·4	.....	.....	.....	.....
2	130	67·1	.....	.....	.....	.....	.....	.....	.....
2	131	.....	.....	68·7	.....	.....	.....	.....	.....
2	134	.....	65·7	.....	.....	.....	.....	.....	.....
2	125	.....	.....	.....	67·4	.....	.....	.....	.....
1	69	.....	.....	.....	.....	85·6	.....	.....	.....
1	67	.....	.....	.....	.....	.....	.....	76·2	.....
1	69	.....	.....	.....	.....	.....	83·6	.....	.....
2	133	.....	.....	.....	.....	68·8	.....	.....	.....
2	132	.....	.....	.....	.....	.....	.....	67·0	.....
2	125	.....	.....	.....	.....	.....	66·4	.....	.....
2	134	.....	.....	.....	.....	.....	.....	.....	68·4

RATION G.—BEANS, ONE PART; SHORTS, THREE-QUARTER PART.

This pen comprised ten pigs. They were all of eastern origin, and weighed at the time of slaughtering from 148 to 205 pounds. The lowest percentage of olein was 79·6; the highest, 92·6. It is thus evident that all would be classed, by olein, as 'very soft.' The inspection rating placed the majority as 'soft.' The growth of the pigs was much below normal, the carcase was meagre and showed very little fat, and that of an extremely oily nature. From every point of view this ration seems most undesirable.

RATION I AND H.—FIRST PERIOD—HALF CORN MEAL; HALF OATS, PEASE AND BARLEY, EQUAL PARTS. SECOND PERIOD—CORN MEAL.

In this ration, half the grain of the first period and all the grain of the second period was corn meal. The effect of this is apparent upon the consistency of the fat. In ration A and B half the grain of the ration throughout life was corn meal, resulting in an average percentage of olein in the mature pigs of 73·2. In the ration

under discussion the average percentage of olein is 77·9. This means an increase of 4¼ per cent olein, due to replacing the oats, pease and barley of the second period by corn. The pens I and H comprised thirty-two pigs. The olein percentages under the varying conditions are as follow :—

	Percentage of Olein.
Boiled grain	79·0
Dry grain	76·7
Eastern pigs	78·6
Western pigs	77·2
Inside	77·8
Outside	77·9
Average of all	77·9

Inspection ratings :—

	V.F	F.	M.F.	S.	V.S.
Boiled grain	..	2	3	9	2
Dry grain	1	3	..	6	6
Eastern pigs	1	5	2	6	2
Western pigs	..	1	1	10	4
Inside	1	2	1	9	3
Outside	..	2	3	8	3

TABLE X.

Ration I and H.—First period, one-half Corn Meal, one-half Oats, Pease and Barley in equal parts; second period, Corn Meal.

No. of Pigs.	Dressed Weight.	Percentage of Olein.							
		Boiled.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
	Lbs.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
4	125	80·8	.....	.....	.....	.....	.....	.....	.....
4	130	.....	.....	79·5	.....	.....	.....	.....	.....
4	130	.....	78·3	.....	.....	.....	.....	.....	.....
4	132	.....	.....	.....	77·5	.....	.....	.....	.....
4	132	.....	.....	.....	.....	74·7	.....	.....	.....
4	137	.....	.....	.....	.....	.....	.....	79·2	.....
4	137	.....	.....	.....	.....	.....	77·5	.....	.....
4	133	.....	.....	.....	.....	.....	.....	.....	75·5

RATION J. AND L.—FIRST PERIOD—CORN MEAL.

SECOND PERIOD—OATS, PEASE AND BARLEY, EQUAL PARTS.

In planning this ration it was thought that any softening effect of the corn during the first period might be counteracted by using a grain feed not containing corn in the second or finishing period.

This has proved to be true to a large extent, as will be seen by comparing the average percentage of olein from the corn ration (Table VII.), namely. 92·3 with that obtained under consideration, 77·6. Nevertheless, our data show conclusively that when the animal is fed to a weight of 100 pounds on corn exclusively, the corrective action of such an excellent ration as oats, pease and barley is not sufficient to render the fat firm. Indeed, the olein values are very close to those obtained with ration I and H, just discussed.

	Percentage of Olein.
Soaked grain	76·4
Dry grain	78·8
Eastern pigs	76·4
Western pigs	78·9
Inside	76·5
Outside	78·7
Average of all	77·6

Inspection ratings—

	V.F	F.	M.F.	S.	V.S.
Soaked grain	..	3	1	4	..
Dry grain	..	1	1	5	1
Eastern pigs	..	4	2	2	..
Western pigs	..	..	..	7	1
Inside	..	2	2	4	..
Outside	..	1	..	6	1

TABLE XI.

Ration J and L.—1st Period, Corn Meal; 2nd Period, Oats, Pease and Barley, in equal parts.

No. of Pigs.	Dressed Weight.	Percentage of Olein.							
		Soaked.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
	Lbs.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
2	135	70·7	.....	.....	.....	.....	.....	.....	.....
2	125	.....	.....	76·6	.....	.....	.....	.....	.....
2	127	.....	80·5	.....	.....	.....	.....	.....	.....
2	137	.....	.....	.....	77·9	.....	.....	.....	.....
2	149	.....	.....	.....	.....	77·4	.....	.....	.....
2	130	.....	.....	.....	.....	.....	.....	80·8	.....
2	125	.....	.....	.....	.....	.....	77·4	.....	.....
2	128	.....	.....	.....	.....	.....	.....	.....	79·6

RATION K AND M.—FIRST PERIOD—OATS, PEASE AND BARLEY, IN EQUAL PARTS.

SECOND PERIOD—CORN MEAL.

This ration is the reverse of the preceding, corn meal being used as the finishing instead of the initial grain. The result was a firmer fat, containing 3·5 per cent (average) less olein. The fat of the greater number of the pigs, however, showed too much oiliness to allow the pork to be classed as of first quality.

	Percentage of Olein.
Soaked grain	73·5
Dry grain	74·4
Eastern pigs	74·4
Western pigs	73·4
Inside	73·0
Outside	74·8
Average of all	73·9

Inspection ratings—

	V.F	F.	M.F.	S.	V.S.
Soaked grain	1	1	1	4	1
Dry grain	..	2	3	3	..
Eastern pigs	1	1	2	4	..
Western pigs	..	2	2	3	1
Inside	..	1	3	3	1
Outside	..	3	4	..	1

TABLE XII.

Ration K and M.—1st Period, Oats, Pease and Barley, in equal parts; 2nd period, Corn Meal.

No. of Pigs.	Dressed Weight.	Percentage of Olein.							
		Soaked.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
	Lbs.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
2	139	74·2	.....	.....	.....	.....	.....	.....	.....
2	137	.....	.....	76·2	.....	.....	.....	.....	.....
2	129	.....	70·4	.....	.....	.....	.....	.....	.....
2	134	.....	.....	.....	73·0	.....	.....	.....	.....
2	136	.....	.....	.....	.....	70·3	.....	.....	.....
2	130	.....	.....	.....	.....	.....	.....	76 8	.....
2	142	.....	.....	.....	.....	.....	77·2	.....	.....
2	135	.....	.....	.....	.....	.....	.....	.....	73·1

CONDITIONS UNDER WHICH THE PIGS WERE FED CONSIDERED AS FACTORS.

Before discussing the three last rations of this series, N, O, and P, which were fed to eastern animals, we may consider to what extent the condition of the grain (soaked or dry), the locality or district in which the pigs were littered, and the amount of exercise obtainable, may have had upon the quality of the pork.

The inferences on these points are drawn from the olein content, that being undoubtedly the most reliable factor from which to make deductions. Finished animals only are considered.

Boiled as against dry grain.—In the sets of experiments A and B, half corn meal, half oats, pease and barley, boiled and dry, and I and H, first period, half corn meal, half oats, pease and barley, boiled and dry, we find that the fat produced from boiled grain in each case was the softer. In A and B the difference was 2·2 per cent olein, in I and H, the difference was 2·3 per cent olein.

Soaked as against dry grain.—This comparison was made with corn meal (C and E), a mixture of oats, pease and barley, (D and F), with rations employing during the first period corn meal, and second period oats, pease and barley (J and H), and lastly, first period, oats, pease and barley; second period, corn meal (K and M). The results are:

Percentages of olein—

	C & E	D & F.	J & H.	K & M.
Soaked..	92·5	67·2	76·4	73·5
Dry	92·1	67·7	78·8	74·4

We scarcely feel justified, from these data, in drawing any conclusions as to the relative effect on firmness of the same grain ration, fed soaked or dry. A study of the individual results does not reveal any definite tendency, and most probably the condition of the grain in this respect has but little, if any, effect on the quality of the pork.

Eastern origin as against western.—This feature was allowed for under all the rations tested. The averages are in the order as discussed :—

	A & B.	C & E.	D & F.	I & H.	J & L.	K & M.
Eastern origin	73·4	91·2	67·9	78·6	76·4	74·4
Western origin	73·0	93·4	67·0	77·2	78·9	73·4

In four cases out of the six, the olein of the eastern pigs is somewhat the greater, and taken together the averages give a total excess of 3·7 per cent olein over the corresponding western groups. In two cases the western pigs show the larger olein per cent, amounting to 4·7 per cent olein over the corresponding eastern groups. These facts do not warrant us in supposing that there is any marked tendency towards softness in finished pigs due simply to western origin, as is thought by some packers. If finished pigs from the western part of Ontario are softer than those from the eastern, it must be due to the character of the feed they obtain.

Inside as against Outside.—As already explained, the pigs denoted as 'inside' are held to have had opportunities for limited exercise only, that is, in the small yards attached to the pens of the piggery; the 'outside' pigs had the run of an inclosure in which there was a movable sty or shelter for their accommodation at night.

The averages are as follow :—

Percentages of olein—

	A & B.	C & E.	D & F.	I & H.	J & L.	K & M.
Inside	71·9	92·3	67·0	77·8	76·5	73·0
Outside....	74·5	92·3	67·9	77·9	78·7	74·8

In several of these instances, it will be seen, the results are practically identical (for differences of less than one per cent must not be considered as forming a sufficiently strong basis from which to draw conclusions) ; in the other cases, the larger amount of olein appears in the fat of the 'outside' pigs. There can be no doubt as to the value of a sufficiently large run for young and growing pigs ; exercise to a limited extent in the earlier period of an animal's life is essential to a strong and thrifty growth, to good digestion and assimilation of the food.

We, therefore, do not think it wise, without further evidence, to draw the conclusion that the larger area for exercise had any injurious effect on the quality of the pork. Indeed, a survey of the two seasons' results makes it very clear that the character of the food is the one great influencing factor, and that the varying features or conditions, other than the ration, had very little to do with the relative firmness of the resulting fat.

RATION N, O AND P.—N.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY, EQUAL PARTS. DRY.

O.—GRAIN AS IN N. PLUS MANGELS.

P.—GRAIN AS IN N. PLUS STEAMED CLOVER.

This experiment comprising six pigs under each ration, was instituted to ascertain what the effect would be upon the relative firmness by adding (*a*) mangels, and (*b*) steamed clover to the grain ration, which, it will be noticed, is the same as under tests A and B. It is thus seen that B and N are duplicate tests in every particular. For this reason, it will be instructive to place the averages of A and B with those from the rations under discussion :

	Percentage of Olein.
Ration B, average of 12 pigs	73·1
" N " 6 pigs	73·7
" O " 6 pigs	74·9
" P " 6 pigs	76·1

By the olein test, B and N are practically identical. The addition of mangels somewhat raised the percentage of olein, but perhaps not to a degree sufficient to warrant any statement as to their effect upon the pork. The steamed clover, however, appeared to notably increase the olein. Very few of the carcases from these rations fall into the classes of firm and moderately firm, the influences of the corn (forming half the grain ration) being apparent.

The inspection ratings are as follow :—

	V.F.	F.	M.F.	S.	V.S.
N	..	2	3	1	..
O	..	1	1	4	..
P	..	..	4	2	..

SECOND SERIES OF FEEDING TRIALS, 1900.

On the completion of the work of the first set of experiments, it was thought desirable to institute a further series to obtain corroboration of certain results, as well as to ascertain the influence of several modifications in the rations already employed. In this second series, the effect of the ration on the fat of the finished pig simply was determined. Further, it was considered unnecessary to repeat the details as regards eastern and western origin, limited and unlimited ration, exercise, &c., these factors, it having been shown, possessing little, if any, influence on the relative firmness of the resulting pork. It was also decided to examine chemically the fat taken from above the shoulder only, the difference in olein content between the shoulder and loin fat from the same carcase being, as a rule, extremely small. We have, therefore to consider in the trials about to be discussed the percentage of olein in the rendered shoulder fat, the melting point of the fat, and the inspection ratings taken at the packing house.

An improved and more accurate method of taking the melting points having been perfected in our laboratories during the winter of 1899-1900, it will be found that there is a closer agreement in this second series between the olein content and the melting point of the fat than is apparent in the data of the first series. The scheme of rations is detailed as follows :—

RATIONS.

1.....Oats, pease and barley, ⅓ each.

2.....Corn meal.

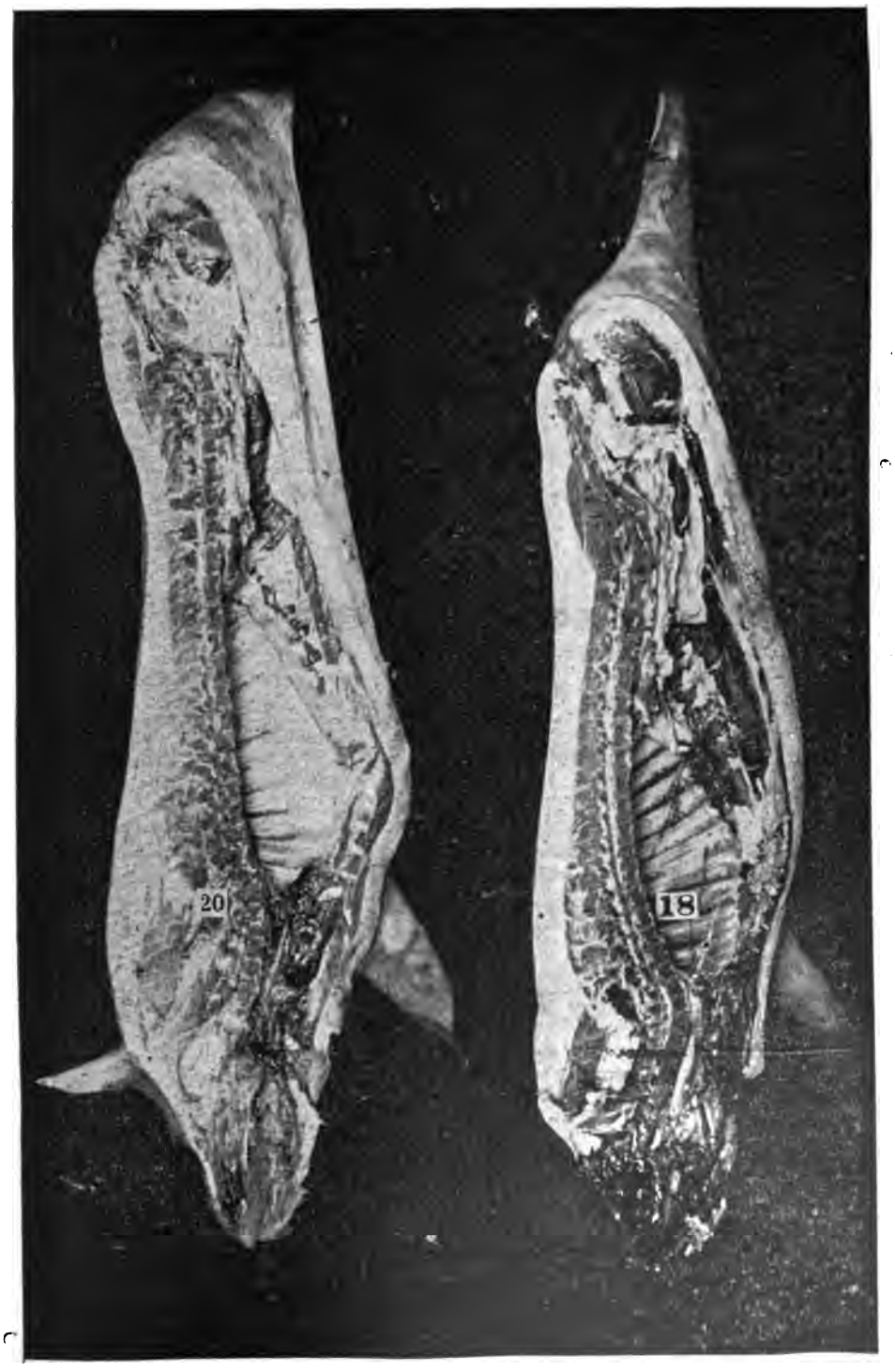
3.....Corn meal and skim-milk.

4.....Pease.

5.....Beans.

6.....½ corn meal.
½ oats, pease and barley, ⅓ each.

7.....½ corn meal.
½ oats, pease and barley, ⅓ each, plus skim milk.



No. 20 { HALF CORN MEAL.
HALF OATS, PEASE AND BARLEY

No. 18 { 1ST PERIOD, HALF CORN MEAL; HALF OATS, PEASE AND BARLEY.
2ND PERIOD, CORN MEAL.

8.....First Period—½ corn meal ; ½ oats, pease and barley, ⅓ each.
Second Period—Corn meal.

9.....First Period—Oats, pease and barley, ⅓ each.
Second Period—Corn meal.

10.....½ corn meal ; ½ oats, pease and barley, ⅓ each.
Pastured first on rape, finally on artichokes.

11.....First Period—½ corn meal ; ½ oats, pease and barley, ⅓ each. Pastured on rape.
Second Period—Same grain ration, plus raw pumpkins.

12.....½ corn meal ; ½ oats, pease and barley, ⅓ each, plus cooked pumpkins.

13.....½ corn meal ; ½ oats, pease and barley, ⅓ each. From October 16, ½ corn meal, ½ pease.

14.....½ corn meal ; ½ oats, pease and barley, plus artichokes.

15.....First Period—Pastured on clover.
Second Period—From October 30, fed clover, plus ½ corn meal, ½ oats, pease and barley, ⅓ each.

16.....First Period—Corn meal.
Second Period—Oats, pease and barley, ⅓ each.

17.....A—½ corn meal ; ½ oats, pease and barley, ⅓ each, skim-milk and turnips.
B—½ corn meal ; ½ oats, pease and barley, ⅓ each, skim-milk and mangels.
C—½ corn meal ; ½ oats, pease and barley, ⅓ each, skim-milk and sugar beets.

Comparing the foregoing with the rations of the first series, it will be observed that the experiments with the following were duplicates : (*a*) the oats, pease and barley mixture, (*b*) corn only, (*c*) half corn, half oats, pease and barley mixture, (*d*) first period, corn meal ; second period, oats, pease and barley mixture ; (*e*) first period, oats, pease and barley mixture ; second period, corn meal ; (*f*) first period, half corn, half oats, pease and barley mixture ; second period, corn meal ; and (*g*) beans. In addition to these, the following rations found a place : (*a*) pease, (*b*) corn meal and skim-milk, (*c*) half corn meal, half oats, pease and barley mixture and skim milk, and several rations in which the grain was half corn meal, half oats, pease and barley with (*a*) pumpkins, (*b*) artichokes, (*c*) rape, (*d*) clover, and three pens with this same grain ration plus skim milk and mangels, turnips and sugar beets, respectively.

In Table XIII. we have arranged the rations in order of olein content, beginning with the firmest pork.

TABLE XIII.—AVERAGES from Determinations of 2nd Series, 1900.

No. of Ration.	Composition of Ration.	Olein.	Melting Point.
17 C	½ corn meal; ½ oats, pease, barley, ⅓ each and skim milk, sugar beets	66·9	32·3
4	Pease	67·2	32·5
17 B	½ corn meal; ½ oats, pease, barley, ⅓ each skim milk and mangels	68·2	32·7
1	Oats, pease and barley, ⅓ each	68·7	32·4
17 A	½ corn meal; ½ oats, pease, barley, ⅓ each and skim milk; turnips	70·4	32·3
3	Corn meal and skim milk	70·9	33·3
7	½ corn meal; ½ oats, pease, barley, ⅓ each and skim milk	72·3	31·1
13	½ corn meal; ½ oats, pease and barley ⅓ each. From Oct. 16, ½ corn meal, ½ pease.	72·3	31·2
12	½ corn meal; ½ oats, pease, barley, ⅓ each and cooked pumpkins	73·3	31·4
14	½ corn meal; ½ oats, pease, barley and artichokes	73·4	31·5
9	1st period: oats, pease, barley ⅓ each; 2nd period, corn meal	73·9	31·1
11	1st period: pastured on rape, ½ corn meal, ½ oats, pease and barley ⅓ each; 2nd period, raw pumpkins and same grain	74·2	31·6
6	½ corn meal; ½ oats; pease and barley, ⅓ each	74·6	30·3
10	½ corn meal; ½ oats, pease and barley, ⅓ each; pastured first on rape, finally on artichokes	74·9	32·4
16	1st period: corn meal; 2nd period, oats, pease and barley, ⅓ each	76·1	30·9
15	Pastured on clover, From Oct 30, fed clover, ½ corn meal; ½ oats, pease and barley, ⅓ each	76·1	30·3
8	1st period: ½ corn meal; ½ oats, pease and barley, ⅓ each; 2nd period, corn meal.	77·9	30·8
2	Corn meal only	83·6	28·6
5	Beans	84·9	29·5

RATION No. 1.—OATS, PEASE AND BARLEY, IN EQUAL PARTS.

In all the pigs of this pen the fat was very firm, not too thick and of even deposition.

By inspection rating, all were classed as 'very firm'; by olein content, three would be 'very firm' and two 'firm.'

The average percentage of olein from the present ration indicates a very high quality of pork and is practically identical with that obtained in the first series. This is undoubtedly from every standpoint a most satisfactory ration.

RATION No. 2.—CORN MEAL.

The results with corn meal used exclusively are, as in the ration just considered, in close agreement with those of the same ration under the first series, though in the former test the average percentage of olein was somewhat higher, probably owing to the pigs being younger when the feeding was commenced. In the pen of the second series the animals when put upon the ration were about one month older than those of the first series, and this undoubtedly led to a better, quicker and more normal growth.

We have, therefore, in this second test with corn meal ample corroboration for our conclusions as to the disastrous effect of this ration (see page 19) and its unsuitability in pig feeding. All the pigs, both by olein content and inspection rating, were classed as 'very soft.'

RATION No. 3.—CORN MEAL AND SKIM MILK.

This ration has afforded us some of the most striking results in the whole series. The effect of the skim milk in hardening the fat of these corn fed pigs has been most remarkable. Skim milk, it is seen, has placed these pigs well up on the list of averages. Corn meal without this corrective gave such an exceedingly soft pork that the pigs in the first series are last, and in the second series next to last in the order of merit. With skim milk, the growth was much more rapid and thrifty than with corn meal only (as will be seen from the illustration given of these pens), and this, no doubt, is largely due to the nitrogenous nutrients furnished by the milk, and which, as we have before remarked, are to a great extent lacking in corn, which supplies, essentially, starch and oil. This ration (No. 3) is not, however, so suitable as one of mixed grains (oats, pease and barley) for pork production, for in several of the pigs of this set, the fat along the back was too thick. From our experiments we conclude, then, that while a ration of corn exclusively resulted in a very meagre growth and only a slight deposition of fat—and that of an extremely soft and oily character—the addition of a sufficiency of skim milk to supply the necessary nitrogenous matter tended to a rapid growth and the production of a fairly firm fat, which, however, in many instances, was too thick for the bacon trade. The present results are most valuable and important in showing the beneficial effect of skim milk in promoting a thrifty growth and in counteracting the softening effect of the corn upon the pork, but looking to economy of production, thickness and quality of fat, a mixed grain ration, such as we have referred to above, will, we believe, give better returns.

It would probably be hard to overestimate the value of skim milk as part of every ration, especially for young pigs; the fact here brought out regarding its hardening effect upon the fat shows it to have an additional function of great importance.

The ratings by olein are: four firm, two moderately firm; by inspection we have: one very firm, one firm, two moderately firm, one soft, one very soft. The average percentage of olein for the set is 70·9, which gives it a rank of 'moderately firm.'

RATION No. 4.—PEASE.

Four of the six pigs in this group ranked 'very firm,' both by olein and inspection rating. Omitting one animal, regarding which we have some doubt, but the data of which have been allowed to stand in the table of details, the average percentage of olein for the group is 67·2, which places this ration practically at the head of our second series. The pigs made good growth, were well nourished, and the fat evenly deposited along the back (from 1¼ to 1½ inches thick) and extremely firm. These results confirm the good opinion generally held with regard to pease, and furnish proof of their desirability in the ration for obtaining the finest quality of pork.

RATION No. 5.—BEANS.

As in the first series, all the pigs under this ration gave an extremely soft fat. The average percentage of olein was 84·9, that of the first series being 85·2—figures practically identical. Both by olein and inspection rating, the fat was classed as 'very soft.' We have in this pen, therefore, confirmatory evidence as to the unsuitableness of beans for fattening pigs. The deductions made from our first experiment with beans might be repeated for those of the second series (see page 22).

RATION No. 6.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY, IN EQUAL PARTS.

This is a repetition of ration A and B in the first series and the data obtained are in close accordance with those already recorded for this grain mixture. In the first series, the average percentage of olein was 73·2 ; in the second, 74·6, which places the group among those marked as 'soft.'

The present inspection ratings are :—One very firm, one firm, two moderately firm and two soft ; by olein content we have five of the six pigs on the line between soft and moderately firm, and one moderately firm.

Our results in this second series, therefore, confirm the conclusions already drawn, namely, that this ration continued throughout life has the tendency towards the production of a soft, oily fat.

RATION No. 7.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY, PLUS SKIM MILK.

This ration only differs from the preceding in the addition of skim milk. It had no counterpart in the first series. The skim milk here has had a corrective effect, though not in the same degree as when used with corn only. It lowered the average percentage of olein from 74·6 (see preceding ration) to 73·3, placing the group in 'moderately firm' instead of 'soft.' A study of the detailed data (see Table 7, page 44), reveals that the individuals of this pen varied considerably in olein content, and, further, that the agreement between olein ratings and inspection ratings is not so close as in most of the other groups. We can scarcely offer any good reason for this, but from a careful consideration of the whole matter, we feel confident in placing the greater weight upon the olein values. Very frequently examination after smoking the bacon has confirmed the lower olein values. By olein content we find practically four classed as 'firm,' one as 'soft,' and one as 'very soft.' By inspection rating we have three as very firm, one moderately firm and one soft.

RATION No. 8.—FIRST PERIOD, HALF CORN MEAL, HALF OATS, PEASE AND BARLEY.

SECOND PERIOD, CORN MEAL.

This is a duplicate of ration I and H of the first series, under which thirty-two animals were tested. It is perhaps a coincidence, though certainly one not to be lightly passed over, that the average percentage of olein in both series is the same, 77·9, and thus both groups, as such, are placed in the category of very soft.

Many of the pigs, as in the first series, had too thick a fat along the back. As with the preceding ration, considerable discrepancies are to be observed between the two classes of ratings of the individual animals, but the close accord of the olein values with those of the first series, leaves no doubt as to the character of the fat, and points unmistakably to the softening effect of this ration.

RATION No. 9.—FIRST PERIOD, OATS, PEASE AND BARLEY IN EQUAL PARTS.

SECOND PERIOD, CORN MEAL.

The results from this ration may be compared with those of K and M of the first series, the rations being the same. Here, again, we find the average olein content for the group to be the same in both series, namely, 73·9, and consequently the deductions already made might be repeated. In the majority of cases the fat

was too soft and oily to allow the pork to be classed as of first quality. It was also noticed, as in the first series, that most of the carcases showed too thick a deposition of fat. We receive in these data corroboration of the statement made when discussing the first series, that this ration gives a fat containing less olein than one in which corn meal forms half of the first period food, and consequently forms a part or whole of the ration throughout life.

RATION No. 10.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY, IN EQUAL PARTS. PASTURED FIRST ON RAPE AND FINALLY ON ARTICHOKES.

This is seen to be the same grain ration as No. 6 of this second series, the difference being in the addition of rape and artichokes. The average percentage of olein for the group is 74·9, being only three-tenths of a per cent more than that of the grain ration alone. It seems scarcely advisable, therefore, to make any inference as to the effect of the rape and artichokes, further than to say that these crops do not appear to correct in any degree the softening effect of the corn meal. The pigs of this group showed a tendency to develop too thick a shoulder fat.

RATION No. 11.—FIRST PERIOD, HALF CORN MEAL, HALF OATS, PEASE AND BARLEY MIXTURE, PASTURED ON RAPE.

SECOND PERIOD, SAME GRAIN RATION AND RAW PUMPKINS.

This ration differs only from the preceding in the substitution of raw pumpkins for artichokes in the second period. The differences in the consistency of the fat of the individual pigs are not large. The average percentage of olein is 74·2. This is a fraction of a per cent less than in No. 6, in which the same grain ration was continued throughout without rape or pumpkins. While, therefore, it is impossible to say that these forage crops had any very marked effect in correcting the softening action of the corn meal, we can at least state they did not increase the softness of the pork.

RATION No. 12.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY MIXTURE, AND COOKED PUMPKINS.

This group of pigs gave a somewhat lower percentage of olein—indicating a firmer fat—than most of the others on the same grain ration, the majority of them falling into the firm and moderately firm groups. The average percentage of olein for the group is 73·3, practically the provisional limit for the moderately firm class.

RATION No. 13.—FIRST PERIOD, HALF CORN MEAL, HALF OATS, PEASE AND BARLEY.

SECOND PERIOD, HALF CORN MEAL, HALF PEASE.

Three of the five pigs of this group were classed by their olein content as 'firm,' one as moderately firm and one as soft. The average percentage of olein for the group was 72·3, placing the group equal in the scale of firmness with that from Ration No. 7. The inspection ratings gave three as 'very firm' and two as 'moderately firm.' If compared with No. 6 the good effect of the pease (forming half of the ration of the second period) is noticeable.

RATION No. 14.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY IN EQUAL PARTS AND ARTICHOKES.

The results of this ration are practically the same as those from No. 12, the average olein content for the two groups being 73·3 and 73·4 respectively. By the percentage of olein, one was classed 'firm,' two 'moderately firm,' and two 'soft.'

RATION No. 15.—FIRST PERIOD, PASTURED ON CLOVER. SECOND PERIOD, HALF CORN MEAL, HALF OATS, PEASE AND BARLEY AND CLOVER PASTURAGE.

As will be seen from the table of data, this is a very uneven group as regards olein content ; three would be classed as very soft, one as moderately firm, and two as firm. The average olein content is 76·5, placing the group well down in the order of firmness. The olein average for the group (No. 6) on this grain ration without clover is 74·6. These data appear to indicate, therefore, that clover has a softening effect when continued throughout the whole feeding period. Comparing the olein content of this group with that of pen P of the first series, fed with the same grain mixture plus steamed clover, we find very little difference—the latter being 76·1 per cent—and this fact strengthens our opinion that clover increases the percentage of olein. Clover could possibly be used without detriment in more limited quantities, especially if used in conjunction with skim milk.

RATION No. 16.—FIRST PERIOD, CORN MEAL. SECOND PERIOD, OATS, PEASE AND BARLEY, IN EQUAL PARTS.

This ration is the reverse of No. 9 of the present series and a repetition of J and L of the first series.

As in the previous set of experiments, we find that corn meal fed during the first period (till the animal weighed 100 pounds) and finally oats, pease and barley, produced a somewhat softer fat than when corn is fed in the finishing period, preceded by oats, pease and barley.

Compared with the former data from the same ration, the present results show a somewhat firmer fat, the percentage of olein being 76·0 as against 77·6 ; the difference, however, is not sufficient to raise the group from the class of 'very soft,' in which the first set of pigs on this ration was placed.

RATION No. 17.—A.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY, SKIM MILK AND TURNIPS.

B.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY, SKIM MILK AND MANGELS.

C.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY, SKIM MILK AND SUGAR BEETS.

The grain mixture for these groups, it will be observed, is the same as that which has been employed in a number of the experiments. Skim milk, however, has been fed to all the pigs throughout life and various roots—as indicated above—tried in the subdivisions, each of which comprised four animals. The results obtained have been satisfactory, the growth was good, the fat very firm and as a rule not too thick. From the table of averages (page 30) it will be observed that these three groups stand well at the head in the scale of firmness. The olein and inspection ratings are closely concordant, placing the animals in the classes of 'very firm' or 'firm.'

Group 'B' is the same as ration 'O' of the first series, save that in the present trial skim milk was fed. The difference in the olein content—6·7 per cent—in favour of Ration 17, Group 'B,' may, I think, be fairly attributed to the effect of the skim milk. Of the three groups, that with sugar beets gave the firmest fat; that with turnips, the least firm.

In all three groups we have confirmed in the most marked manner the corrective and beneficial action of skim milk, which was more particularly referred to when discussing the corn and skim milk ration.

CONCLUSIONS FROM SECOND SERIES OF EXPERIMENTS.

On page 15 we have given the chief inferences to be drawn from the results of the first set of experiments. In all important features these deductions receive strong confirmation from the data of the second series. There are, however, from this latter series several additional and important features to be noted. The first is with regard to the use of skim milk in conjunction with the grain ration. **In every instance in which it has been tried, skim milk has produced a much firmer fat than resulted from the same grain ration, fed without skim milk.** The softening effect of corn, so repeatedly referred to, has in a very large measure been counteracted by this means. Therefore, while our results point to the injurious effects of a ration containing one-half or more corn without skim milk, we have to record that its use as a part of the grain ration in conjunction with skim milk has produced an excellent quality of pork. It will have been noticed, however, in the discussion of several of the rations, that a large proportion of corn in the ration tends to an increase in the deposition of fat, especially above the shoulder.

Clover has not been tried save in conjunction with a grain ration, half of which was corn meal. We are scarcely in a position, therefore, to speak positively as to its effect upon the relative firmness, but there are certainly strong indications that its influence is in the same direction as corn, increasing the percentage of olein.

It is quite evident that the root crops—turnips, mangels and sugar beets—can be used with benefit and with impunity in such a ration as we have in No. 17, the animals of which produced a first quality pork.

Further, we do not notice any softening effect due to the results of feeding rape, artichokes, or pumpkins, cooked or raw.

SUMMARY.

Among the more important conclusions to be drawn from this investigation are the following :—

1. That the one great controlling factor in the quality of the pork of finished pigs lies in the character of the food employed.

2. That Indian corn and beans tend to softness, *i.e.*, to increase the percentage of olein in the fat. If these grains are used they must be fed judiciously if first class firm pork is to be produced. If fed in conjunction with skim milk it has been shown that a considerable proportion of Indian corn may be used in the grain ration without injuring the quality of the pork.

3. That a grain ration consisting of a mixture of oats, pease and barley, in equal parts, gives a firm pork of excellent quality.

4. That skim milk not only tends to thriftiness and rapid growth, but counteracts in a very marked manner any tendency to softness.

5. That rape, pumpkins, artichokes, sugar beets, turnips and mangels can be fed in conjunction with a good ration without injuring the quality of the pork.

6. That the fat of very young pigs and animals of unthrifty growth is softer than that of finished pigs that have increased steadily to the finishing weight.

---

*As already indicated, there has been a very large amount of analytical work in connection with this investigation, and the writer is anxious to acknowledge with thanks his indebtedness to the assistant chemists, Mr. A. T. Charron and Mr. H. W. Charlton, by whom much of it was successfully undertaken. They rendered most efficient help in the prosecution of this research.

APPENDIX

SERIES I.—RATION A.

½ Corn Meal..... .....
½ Oats, Pease and Barley, in equal parts. } Boiled.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	68	East....	Oct. 26...	98	67	77·3	32·7	V. S.	V. S.
Outside.	104	"	Nov. 7....	102	67	77·1	31·6	V. S.	V. S.
"	106	"	" 14....	96	61	81·2	28·6	V. S.	V. S.
Inside..	2	West...	Sept. 26....	103	66	91·6	32·3	V. S.	V. S.
"	61	East...	Nov. 21....	181	129	71·5	34·0	S.	M. F.
"	65	" ...	Oct. 26....	180	127	73·9	34·6	S.	S.
"	66	"	Dec. 5....	191	126	74·8	33·7	S.	S.
"	69	"	Feb. 10....	181	125	71·8	34·5	S.	M. F.
Outside.	101	"	Jan. 5...	211	145	71·8	32·6	M. F.	M. F.
"	105	"	Feb. 3....	180	130	79·1	32·0	S.	V. S.
"	107	"	Jan. 13....	205	140	75·9	.....	F.	S.
"	109	"	Feb. 3....	187	130	75·6	32·8	S.	S.
Inside..	1	West...	Nov. 14...	183	130	71·5	34·5	V. S.	M. F.
"	4	"	" 30....	180	118	71·5	32·8	S.	M. F.
"	8	" ...	Jan. 13...	188	.....	78·9	33·9	S.	V. S.
"	10	" ...	Nov. 14....	183	128	72·6	33·9	V. S.	M. F.
Outside.	42	" ...	" 21....	190	126	69·7	34·6	S.	F.
"	45	" ...	Oct. 30. ..	183	124	72·5	33·5	M. F.	M. F.
"	48	" ...	Dec. 29....	190	120	77·1	34·8	F.	V. S.
"	50	" ...	" 29...	190	124	80·8	32·3	S.	V. S.

RATION B.

½ Corn Meal.....
½ Oats, Pease and Barley, in equal parts. } Dry.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	71	East....	Sept. 19....	96	.....	88·1	32·6	V. S.	V. S.
" ..	78	"	Oct. 30....	106	76	72·6	34·1	S.	M. F.
Outside.	115	"	" 18....	106	65	77·9	32·5	S.	V. S.
" ..	119	"	Nov. 7....	97	64	77·5	32·3	S.	V. S.
Inside..	15	West...	Sept. 19....	100	.....	87·1	31·1	V. S.	V. S.
" ..	19	"	" 19....	102	.....	83·7	31·9	S.	V. S.
Outside.	59	"	" 19....	105	....	83·2	32·2	S.	V. S.
Inside..	74	East....	Oct. 18....	188	134	74·0	35·9	S.	S.
" ..	75	"	Nov. 14...	204	146	67·8	33·5	S.	V. F.
" ..	77	"	Jan. 20....	180	139	69·4	32·4	S.	F.
" ..	79	"	" 20....	180	140	70·9	33·2	S.	F.
Outside.	113	" .. .	" 5....	200	142	74·1	32·1	S.	S.
" ..	114	"	Nov. 30....	182	134	70·8	32·1	M. F.	F.
" ..	118	"	Jan. 5....	186	127	74·8	32·3	S.	S.
" ..	120	"	Dec. 29...	212	154	78·2	33·3	F. ?	V. S.
Inside..	14	West...	Oct. 18....	182	130	67·1	38·2	V. F.	V. F.
" ..	13	"	Nov. 14....	192	139	71·0	34·6	S. ?	F.
" ..	17	"	Oct. 5....	182	127	72·1	34·5	S.	M. F.
" ..	20	"	" 26....	184	135	72·5	34·4	S.	M. F.
Outside.	51	"	Nov. 7....	211	149	70·4	35·3	S.	F.
" ..	53	"	Oct. 18....	185	130	73·6	34·3	V. S.	S.
" ..	56	"	Nov. 21....	188	137	71·6	32·8	S.	M. F.
" ..	58	"	" 7....	186	133	75·1	32·4	V. S.	S.

RATION C.

Corn Meal—Dry.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	85	East....	Dec. 21....	107	.....	90·9	27·9	V. S.	V. S.
Outside.	124	" ...	" 8....	98	69	83·6	31·5	V. S.	V. S.
Inside..	21	West...	" 15....	108	76	88·3	29·3	V. S.	V. S.
Outside.	65	" ...	" 8....	102	72	82·9	29·7	V. S.	V. S.
Inside..	84	East....	April 18....	63	46	96·7	Too soft..	V. S.	V. S.
" ..	82	"	Feb. 16....	180	134	79·2	32·0	V. S.	V. S.
Outside.	122	" ...	May 7....	160	117	87·7	Too soft .	V. S.	V. S.
" ..	123	"	April 17....	63	49	97·7	" ..	V. S.	V. S.
Inside..	23	West...	" 30....	140	100	95·3	" ..	V. S.	V. S.
" .	25	" ...	" 18....	111	76	94·6	" ..	V. S.	V. S.
Outside.	62	" ...	May 7....	127	100	92·4	" ..	V. S.	V. S.

RATION D.

Oats, Pease and Barley, in equal parts—Dry.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	87	East ...	Sept. 19....	104	69	85·6	....	V. S.	V. S.
Outside.	128	" ...	Oct. 30....	101	67	76·2	33·0	V. S.	V. S.
Inside..	26	West. .	Sept. 19....	108	69	83·6	31·5	V. S.	V. S.
" ..	86	East ...	Nov. 7....	182	134	69·3	36·5	M. F.	F.
" ..	89	" ...	" 14....	184	132	68·3	34·1	M. F.	V. F.
Outside.	129	" ...	" 30....	188	127	66·4	34·0	M. F.	V. F.
" ..	130	" ...	Jan. 20....	180	137	67 6	34·6	V. F.	V. F.
Inside..	29	West...	Nov. 21....	181	125	67·6	35·2	F.	V. F.
" ..	30	" ...	" 30....	179	126	65·2	34·4	F.	V. F.
Outside.	66	" ...	" 14....	195	134	66·7	33·3	F.	V. F.
" ..	68	" ...	" 14....	188	134	70·1	32·7	F.	F.

RATION E.

Corn Meal—Soaked.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	95	East ...	Dec. 21....	111	78	87·0	....	V. S.	V. S.
Outside.	133	" ...	" 21....	115	83	84·5	30·2	V. S.	V. S.
Inside..	32	West..	Nov. 14....	95	63	84·2	31·0	V. S.	V. S.
Outside.	73	" ...	Dec. 8....	100	71	92·6	27·0	V. S.	V. S.
Inside..	93	East ...	April 18.. .	64	45	97·3	24·5	V. S.	V. S.
" ..	94	" ...	Mar. 15...	178	140	87·0	28·7	V. S.	V. S.
Outside.	132	" ...	April 18....	80	55	98·9	Too soft.	V. S.	V. S.
" ..	134	" ...	May 7....	175	130	85·7	28·3	V. S.	V. S.
Inside..	31	West...	Feb. 16....	181	132	86·4	31·8	S.	V S.
" ..	35	" ...	April 18....	91	63	100·2	Too soft.	V. S.	V. S.
Outside.	74	" ...	May 28....	194	148	90·0	26·3	V. S.	V. S.
" ..	75	" ...	April 18....	100	72	93·7	27·0	V. S.	V. S.

RATION F.

Oats, Pease and Barley in equal parts, soaked.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	100	East....	Oct. 10....	104	71	76·7	34·5	S.	V. S.
Outside.	139	" ...	Nov. 7....	96	60	67·1	38·4	F.	V. F.
Inside..	37	West...	Sept. 19....	100	.....	84·6	30·5	V. S.	V. S.
Outside.	76	" ...	Oct. 5....	102	67	69·3	40·8	F.	F.
Inside..	96	East....	Nov. 21....	179	122	68·5	35·3	M. F.	V. F.
" ..	99	" ...	" 29....	195	138	65·7	37·1	V. F.	V. F.
Outside.	138	" ..	Jan. 5....	195	128	67·5	36·6	F.	V. F.
" ..	140	" ...	Dec. 29....	195	134	69·9	34·6	V. F.	F.
Inside..	36	West...	Oct. 30....	198	130	64·9	35·0	V. F.	V. F.
" ..	40	" ...	Nov. 14....	198	137	66·4	35·0	F.	V. F.
Outside.	77	" ...	" 30....	184	125	65·7	35·0	M. F.	V. F.
" ..	78	" ...	Dec. 15....	179	125	69·1	33·9	F.	F.

RATION G.

Beans, 1 part; Shorts, ¾ part.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Outside.	145	East....	Oct. 30....	109	66	83·9	.....	V. S.	V. S.
" ..	148	" ...	Dec. 29....	205	142	82·5	32·5	S.	V. S.
" .	147	" ...	Jan. 20....	180	130	81·0	32·9	S.	V. S.
" ..	150	" ...	" 20....	180	129	83·5	30·5	S.	V. S.
" ..	143	" ...	Feb. 3....	178	130	79·6	29·5	S.	V. S.
" ..	141	" ...	" 16....	151	102	92 6	Too soft.	V. S.	V. S.
" ..	142	" ...	" 16...	148	95	85·8	.....	V. S.	V. S.
" ..	144	" ...	" 16...	185	121	82·1	.....	S.	V. S.
" ..	149	" ...	" 16....	174	118	86·3	30·4	S.	V. S.
" ..	146	" ...	" 10....	188	133	88·8	30·5	M. F.	V. S.

RATION H.

1st Period . ..... { ½ Corn Meal. ½ Oats, Pease and Barley } Boiled.
2nd " . ..... Corn Meal. }

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	62	East....	Jan. 13....	184	130	80·5	31·5	M.F.	V.S.
" ..	63	" ...	Dec. 5....	183	116	76·5	32·5	S.	V.S.
" ..	67	" ...	April 30....	182	127	87·5	27·5	V.S.	V.S.
" ..	70	" ...	Jan. 13 ...	180	125	78·7	33·0	F.	V.S.
Outside.	102	" ...	" 13...	190	135	73·2	34·0	M.F.	S.
" ..	103	" ...	Mar. 8....	183	136	77·0	33·0	F.	V.S.
" ..	108	" ...	May 7....	175	122	88·4	25·1	V.S.	V.S.
" ..	110	" ...	Mar. 15....	181	128	79·5	29·6	S.	V.S.
Inside..	3	West...	Dec. 5....	189	127	73·8	32·7	S.	S.
" ..	5	" ...	Mar. 8 ...	182	134	84·6	30·2	S.	V.S.
" ..	7	" ...	Feb. 10 ...	201	136	78·6	32·4	S.	V.S.
" ..	9	" ...	Dec. 5....	183	124	76·2	32·2	S.	V.S.
Outside.	41	" ...	" 21....	190	140	74·3	?	S.	S.
" ..	43	" ...	April 30....	172	126	84·0	28·0	S.	V.S.
" ..	46	" ...	Jan. 13....	190	130	76·8	31·8	M.F.	V.S.
" ..	49	" ...	" 20....	180	127	74·8	31·3	S.	S.

RATION I.

1st Period ..... { ½ Corn Meal. ½ Oats, Pease and Barley in equal parts } Dry.
2nd " ..... orn Meal.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	73	East....	Jan. 5 ...	184	129	81.5	32·4	S.	V.S.
" ..	72	" ...	" 13....	180	136	65·9	35·2	V.F.	V.F.
" ..	76	" ...	" 13 ...	183	135	67·5	33·4	F.	V.F.
" ..	80	" ...	May 7....	168	127	83·8	26·8	V.S.	V.S.
Outside.	111	" ...	Jan. 5 ...	192	134	76·2	32·5	S.	V.S.
" ..	112	" ...	Mar. 8....	182	135	83·4	30·7	S.	V.S.
" ..	116	" ...	Feb. 10....	181	135	78·3	32·5	S.	V.S.
" ..	117	" ...	Mar. 8....	195	145	79·0	32·0	M.F.	V.S.
Inside..	11	West...	Dec. 15....	185	145	71·3	32·9	S. ?	M.F.
" ..	12	" ...	" 15....	182	135	79·6	30·6	V.S.	V.S.
" ..	16	" ...	Jan. 20....	180	135	76·8	31·2	S.	V.S.
" ..	18	" ...	Feb. 16....	180	132	82·4	33·0	V.S.	V.S.
Outside.	52	" ...	Nov. 14....	182	127	72·1	31·8	V.S.	M.F.
" ..	54	" ...	" 14....	176	125	72·4	33·0	V.S.	M.F.
" ..	57	" ...	Jan. 5....	197	136	79·9	32·0	S.	V.S.
" ..	60	" ...	" 13....	182	145	77·6	33·5	F.	V.S.

RATION J.

1st Period.....Corn Meal, dry.
2nd " .....Oats, Pease and Barley, in equal parts, dry.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	81	East ...	Mar. 15....	199	137	77·9	31·6	M. F.	V. S.
" ..	83	" ...	May 28 ...	206	160	76·8	28·6	M. F.	V. S.
Outside.	121	" ...	Feb. 23....	186	135	80·5	31·8	S.	V. S.
" ..	125	" ...	" 10....	181	125	81·1	30·4	S.	V. S.
Inside..	22	West...	" 16....	180	125	77·3	33·8	S.	V. S.
" ..	24	" ...	" 23....	179	125	77·5	32·0	S.	V. S.
Outside.	61	" ...	" 10....	180	130	80·8	30·5	V. S.	V. S.
" ..	64	" ...	" 10....	180	126	78·8	31·7	S.	V. S.

RATION K.

1st Period.....Oats, Pease and Barley, in equal parts, dry.
2nd " .....Corn Meal, dry.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	88	East ...	Nov. 14 ...	180	132	69·7	34·4	M. F.	F.
" ..	90	" ...	Dec. 15....	185	140	70·9	33·4	M. F.	F.
Outside.	126	" ...	Feb. 23....	179	125	78·9	32·5	F.	V. S.
" ..	127	" ...	Jan. 13 ...	182	135	74·6	33·8	M. F.	S.
Inside..	27	West...	" 13....	183	143	79·5	32·9	M. F.	V. S.
" ..	28	" ...	Mar. 15....	183	140	74·9	29·9	F.	S.
Outside.	67	" ...	Nov. 30....	187	132	71·7	27·8	S. ?	M. F.
" ..	69	" ...	Dec. 21....	182	137	74·5	34·5	M. F.	S.

RATION L.

1st Period.....Corn Meal, soaked.
2nd " .....Oats, Pease and Barley, in equal parts, soaked.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	91	East....	Mar. 30....	179	133	70·7	33·1	F.	F.
" ..	92	" ...	" 30....	187	138	70·7	31·5	F.	F.
Outside.	131	" ...	" 8....	202	134	74·1	33·9	F.	S.
" .	135	" ...	" 8....	186	116	79·0	31·3	S.	V. S.
Inside..	33	West...	Dec. 29 ...	190	132	81·5	.....	S.	V. S.
" ..	34	" ...	Jan. 5....	190	123	79·6	.....	S.	V. S.
Outside.	71	" ...	Feb. 3 ...	182	134	78·3	32·6	S.	V. S.
" .	72	" ...	" 3 ...	194	140	77·6	31·7	S.	V. S.

RATION M.

1st Period.....Oats, Pease and Barley, in equal parts, soaked.
2nd " .....Corn Meal, soaked.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	97	East....	Dec. 8....	196	142	72·3	32·3	S.	M.F.
" ..	98	" ...	Jan. 20....	190	136	75·9	33·3	S.	S.
Outside.	136	" ...	Feb. 3....	184	140	73·3	32·0	M.F.	S.
" .	137	" ...	" 23....	187	135	79·0	31·7	F.	V. S.
Inside..	38	West...	Nov. 30....	183	128	70·4	33·0	S.	F.
" ..	39	" ...	" 30....	180	130	70·4	32·8	V. S.	F.
Outside.	79	" ...	Dec. 8. ..	180	132	70·5	33·4	S.	F.
" .	80	" ...	Mar. 15....	179	135	75·5	31·4	F.	S.

RATION 'N.' 'O.' 'P.'

'N.'—Half Corn Meal, half Oats, Pease and Barley in equal parts, dry.
'O.'—Grain as in 'N,' plus Mangels.
'P.'—Grain as in 'N,' plus steamed Clover.

Ration.	Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
N	Outside.	13	East.	Ap'l. 9...	197	142	73·1	32·2	M. F.	S.
	"	31	"	" 9...	170	123	72·7	32·0	M. F.	M. F.
	"	34	"	" 9...	173	125	72·8	31·9	F.	M. F.
	"	6	"	" 9...	181	132	72·9	30·0	F.	M. F.
	"	9	"	" 30...	189	130	74·1	31·0	M. F.	S.
	"	12	"	" 30...	180	125	76·4	32·0	S.	V. S.
O.	"	95	"	" 9...	196	136	72·9	31·3	S.	M. F.
	"	93	"	" 9...	186	125	76·6	31·2	S.	V. S.
	"	94	"	" 9...	188	126	76·9	31·0	S.	V. S.
	"	96	"	" 9...	173	115	73·3	31 2	S.	S.
	"	97	"	May 28...	185	137	73·8	32·3	M. F.	S.
	"	98	"	" 28...	161	117	75·9	33·4	F.	S.
P.	"	33	"	Ap'l. 9...	184	130	75·2	33·5	M. F.	S.
	"	4	"	" 9...	183	130	70·8	33·3	M. F.	F.
	"	100	"	" 30...	175	115	77·6	31·4	M. F.	V. S.
	"	2	"	May 28...	191	135	76·8	32·3	M. F.	V. S.
	"	3	"	" 28...	176	117	78·8	31·3	S.	V. S.
	"	32	"	" 28...	185	135	77·4	31·0	S-	V. S.

SERIES 2—RATION 1.

Oats, Pease and Barley, ⅓ each, 1900.

No.	Sex.	Date of Slaughtering	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
243	B	Nov. 8.....	192	134	68·2	32·0	V. F.	F.
244	B	Feb. 13.....	168	122	69·6	32·2	V. F.	F.
245	B	Nov. 30.....	189	137	67·6	33·0	V. F.	V. F.
246	S	Nov. 8.	179	124	71·6	30·0	V. F.	M. F.
247	S	Dec. 8.....	180	126	66·7	33·8	V. F.	V. F.

RATION 2.

Corn Meal.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
225	B.	Dec. 31	187	144	75·8	30·6	F.	V.S.
227	B.	" 31	179	135	82·4	29·0	S.	V.S.
228	S.	Feb. 13 . .	162	118	87·9	27·0	V.S.	V.S.
232	B.	Jan. 28.....	181	133	82·7	29·0	V.S.	V.S.
233	B.	Feb. 13	147	110	87·8	27·8	V.S.	V.S.
236	B.	" 13.. .	158	116	84·9	27·9	V.S.	V.S.

RATION 3.

Corn Meal and Skim Milk.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
237	S.	Oct. 29 . .	198	140	69·9	34·0 ?	F.	F.
238	S.	" 29.....	184	130	73·6	30·5	S.	S.
239	S.	" 29.....	190	135	69·8	35·3	M.F.	F.
240	S.	" 29.....	187	131	70·6	34·6	S.	F.
241	S.	" 29.....	208	150	69·7	34·0	V.F.	F.
242	S.	" 29.....	185	132	72·1	31·3	M.F.	M.F.

RATION 4.

Pease.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
207	B.	Nov. 23....	185	122	69·6	30·1	V.F.	F.
208	B.	Sept. 27....	206	145	81·7	29·7	S.	V.S.
209	S.	" 27....	198	128	73·2	31·0	S.	S.
210	B.	Nov. 23....	191	135	57·4	31·0	V.F.	V.F.
211	B.	Oct. 29 ...	220	155	62·2	35·9	V.F.	V.F.
212	S.	" 29....	201	145	63·4	36·5	V.F.	V.F.

RATION 5.

Beans.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
201	S.	Sept. 27....	193	127	83·2	30·0	S.	V.S.
202	B.	" 27....	183	123	89·9	28·5	V.S.	V.S.
203	B.	Oct. 29....	186	121	80·8	29·0	V.S.	V.S.
204	B.	Dec. 8....	188	121	84·6	30·7	S.	V.S.
205	S.	Feb. 13....	146	99	85·4	28·8	V.S.	V.S.
206	S.	Dec. 31....	180	121	85·9	30·0	V.S.	V.S.

RATION 6.

½ Corn Meal; ½ Oats, Pease and Barley, ⅓ each.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
217	S.	Nov. 8....	186	133	75·2	29·8	S.	V. S.
219	B.	" 23....	190	115	74·2	30·8	V. F.	S.
220	S.	" 8....	179	125	75·2	30·5	S.	V. S.
221	S.	" 23....	193	138	74·8	29·1	F.	S.
223	B.	" 30....	183	134	76·8	30·6	M. F.	V. S.
309	S.	" 8....	205	146	71·4	31·2	S.	M. F.

RATION 7.

½ Corn Meal, ½ Oats, Pease and Barley + skim milk.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
286	S.	Nov. 23....	201	141	71·8	31·1	F.	M. F.
289	B.	" 30....	199	137	76·9	30·2 ?	M. F.	V. S.
291	B.	" 30....	184	131	75·1	31·3 ?	M. F.	V. S.
294	B.	Dec. 31....	203	154	69·0	31·4	V. F.	F.
297	B.	" 31....	205	155	71·3	31·3	V. F.	M. F.
308	S.	Nov. 23....	180	136	69·5	31·1	V. F.	F.

RATION 8.

1st Period.....½ Corn Meal; ½ Oats, Pease and Barley.

2nd " .....Corn Meal.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
214	B.	Dec. 6....	205	143	77·5	31·1	S.	V.S.
215	B.	" 31....	178	130	82·6	29·8	M.F.	V.S.
216	S.	" 31....	194	144	76·6	31·1	V.F.	V.S.
218	B.	" 6....	210	152	75·0	31·0	F.	S.
222	B.	" 6....	190	139	78·7	31·1	S.	V.S.
224	S.	" 31....	195	145	77·2	30·4	F.	V.S.

RATION 9.

1st Period.....Oats, Peas and Barley, + skim-milk.

2nd " .....Corn Meal, commencing Oct. 17, 1900.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
250	B.	Jan. 28....	176	125	75·8	30·7	F.	V.S.
251	S.	" 28....	185	133	74·3	31·0	F.	S.
252	S.	" 14....	187	137	73·3	30·9	S.	S.
253	B.	Nov. 30....	181	135	71·7	32·2	V.F.	M.F.
254	S.	Jan. 14....	187	140	74·8	30·7	S.	S.

RATION 10.

½ Corn Meal; ½ Oats, Pease and Barley; pastured first on Rape, finally on Artichokes.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
279	S.	Dec. 6....	175	126	78·3	?	F.	V. S.
280	S.	" 6....	195	138	65·4	?	F.	V. F.
281	S.	" 6 ...	201	141	76·6	?	F.	V. S.
282	S.	" 6....	171	127	74·9	?	V. F.	S.
283	B.	" 6....	203	150	75·8	?	F.	V. S.
284	S.	" 6....	182	131	78·5	31·4	F.	V. S.

RATION 11.

1st Period—Pastured on Rape; ½ Corn Meal, ½ Oats, Pease and Barley.

2nd " Oct. 3—Same grain ration and Raw Pumpkins.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
261	B.	Nov. 30.....	181	135	73·2	29·3	V F.	S.
262	B.	Dec. 8.....	174	122	75·2	32·5	V.F.	V.S.
265	B.	" 30.... .	180	130	77·8	31·4	F.	V.S.
266	S.	" 30.....	180	132	75·2	30·9	F.	V.S.
272	S.	" 8.... .	191	142	69·9	33·5	V.F.	F.
305	S.	" 8.....	175	127	73·7	32·0 ?	V.F.	S.

RATION 12.

1st Period.....Corn Meal.

2nd " .....Oats, Pease and Barley and cooked Pumpkins.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
292	S.	Dec. 6	185	139	78·1	30·8	F.	V. S.
293	B.	Nov. 30	190	142	70·8	31·2	V. F.	F.
299	B.	" 8 ...	181	135	72·3	31·5	F.	M. F.
300	B.	" 30	190	140	73·2	30·9	V. F.	S.
306	B.	" 8	198	139	69·5	32·4	M. F.	F.
307	S.	Dec. 6	182	137	75·6	31·8	V. F.	V. S.

RATION 13.

1st Period.....½ Corn Meal; ½ Oats, Pease and Barley.

2nd " .....½ Corn Meal; ½ Pease.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
287	S.	Dec. 8....	186	134	80·4	30·1	F.	V. S.
290	S.	Nov. 30....	190	139	73·7	31·1	F.	S.
296	S.	Dec. 31....	182	135	69·0	31·3	V. F.	F.
303	B.	Nov. 8 ...	180	124	68·5	31·8	F.	F.
310	S.	Dec. 31....	197	143	69·9	31·5	V. F.	F.

RATION 14.

½ Corn Meal; ½ Oats, Pease and Barley and Artichokes.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
263	S.	Dec. 6....	191	137	75·9	31·0	F.	V. S.
264	S.	" 6 ...	201	147	70·9	31·1	V. F.	F.
267	B.	" 6....	182	137	73·2	31·3	V. F.	S.
269	S.	" 6....	191	140	75·1	31·8	V. F.	V. S.
271	B.	" 6....	182	131	72·0	32·2	V. F.	M. F.

RATION 15.

1st Period.....Pastured on Clover.

2nd " .....From Oct. 30, fed Clover—½ Corn Meal, ½ Oats, Pease and Barley.

No.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
273..... ...	Nov. 23....	182	130	80·3	30·7	V. F.	V. S.
275...	" 23....	179	120	83·4	28·8	S.	V. S.
276.....	" 23.. .	182	129	79·5	29·2	F.	V. S.
277.....	" 23....	192	137	72·6	30·2	F.	M. F.
278.....	" 23....	238	170	71·2	31·3	V. F.	M. F.
310...	Dec. 31....	197	143	69·9	31·5	V. F.	F.

RATION 16.

1st Period..... Corn Meal.

2nd " .....Oats, Pease and Barley.

No,	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
226	S.	Dec. 31....	180	134	78·9	.....	S.	V. S.
229	S.	" 31....	189	135	75·5	31·0	F.	V. S.
230	S.	Jan. 14....	193	136	74·9	30·9	S.	S.
231	B.	Dec. 31....	186	135	73·3	31·6	V. F.	S.
234	S.	" 31....	180	135	78·7	30·7	M. F.	V. S.
235	S.	Jan. 14....	194	140	75·2	30·6	S.	V. S.

RATION 17.

A—½ Corn Meal, ½ Oats, Pease, Barley and Skim-milk + Turnips.

B— " " " " Mangels.

C— " " " " Sugar Beet.

—	Number of Pig.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
A..	312	May 3..	197	133	71·8	32·0	V.F.	M.F.
A..	313	" 3.....	197	135	70·2	32·5	V.F.	F.
A..	314	" 3.....	189	126	69·6	32·0	F.	F.
A..	315	" 3.....	185	121	70·1	32·7	V.F.	F.
B..	316	" 3.... ...	195	135	65·9	33·0	V.F.	V.F.
B..	317	" 3.....	195	138	68·0	32·3	V.F.	V.F.
B..	318	" 3...	182	125	69·1	32 7	F.	F.
B..	319	" 3.....	194	131	69·6	32·9	V.F.	F.
C..	320	" 3.....	175	118	66·0	32·5	F.	V.F.
C..	321	" 3.....	218	155	66·1	32·5	V.F.	V.F.
C..	322	" 3.....	187	130	69·1	31·9	F.	F.
C..	323	" 3.....	227	157	66·3	32·2	V.F.	V.F.

S
133
.E22

DEPARTMENT OF AGRICULTURE

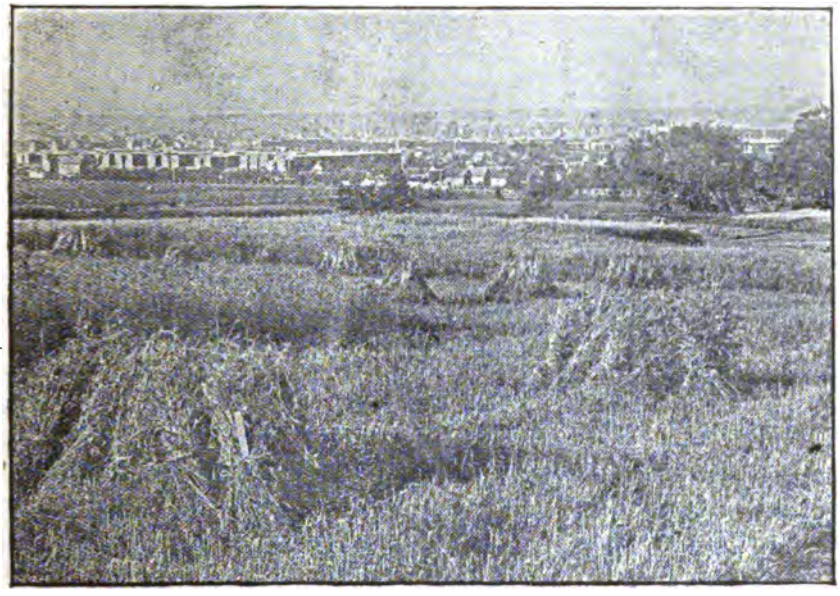
CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

RESULTS OBTAINED IN 1901

FROM

Trial Plots of Grain, Fodder Corn, Field Roots and Potatoes



By Wm. SAUNDERS, LL.D.,
Director Experimental Farms.

BULLETIN No. 39

DECEMBER, 1901

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE.

TABLE OF CONTENTS.

PAGE.

Results of trial plots for 1901.... 7

Varieties of oats.... 8

" barley.... 12

" spring wheat.... 16

" pease.... 19

" Indian corn.... 22

" turnips.... 25

" mangels.... 28

" carrots.... 31

" sugar beets.... 34

" potatoes.... 37

Average crops for a series of years.... 41

Six and seven years' experience with varieties of oats.... 41

" " " barley.... 43

" " " spring wheat.... 45

Four to seven years' experience with varieties of pease.... 47

Five to seven years' experience with varieties of Indian corn.... 48

Five and six years' experience with varieties of turnips.... 50

Five and six years' experience with varieties of mangels.... 51

" " " carrots.... 52

Four and five years' experience with varieties of sugar beets.... 53

Five and seven years' experience with varieties of potatoes.... 54

Summary.... 55

To the Honourable

The Minister of Agriculture.

SIR,—I herewith submit for your approval Bulletin No. 39 of the Experimental Farm series, which has been prepared by myself. There are presented in this publication the results of a large number of experiments, which have been conducted at all the experimental farms under your Department during the season of 1901, with oats, barley, spring wheat, pease, Indian corn, turnips, mangels, carrots, sugar beets and potatoes in plots of uniform size, and the crops grown under uniform conditions. The average results also are given of six and seven years' tests on such plots with varieties of oats, barley and spring wheat, four to seven years with plots of pease, five to seven years with plots of Indian corn and potatoes, five and six years with plots of turnips, mangels and carrots, and four to five years' experience with sugar beets.

These trial plots are conducted with the object of gaining information as to the relative productiveness of the different sorts and their earliness in ripening. The returns show much variation in the weight of the crops grown and point to the importance of care in the choice of varieties of seed for sowing. It is hoped that these results giving the experience gained under some of the most important climatic variations found in the country will prove useful to farmers in every part of Canada.

I have the honour to be,

Your obedient servant,

WM. SAUNDERS,

Director Experimental Farms.

OTTAWA, December 20, 1901.

RESULTS OBTAINED IN 1901

FROM TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS AND POTATOES.

By William Saunders, LL.D., F.R.S.C., F.L.S., &c.

Director Experimental Farms.

Seven years ago a number of experiments were undertaken at each of the Dominion Experimental Farms with the object of gaining information as to the best, most productive and earliest ripening varieties of grain, fodder corn, field roots and potatoes. In arranging for these uniform trial plots the same varieties were sown at each of the farms, the seed being supplied from a common stock. The seed in each case has been sown early and as a rule all the varieties of the same product have been sown on the same day or at the most within two or three days, so as to give to all in this respect an even start. The land chosen each year for these plots has been as nearly uniform in character as could be found, and before sowing has been brought into a good condition of tilth. In this bulletin, which is the seventh of the series, the particulars are arranged after the same plan as in previous issues, the different varieties being placed in the tables which follow the order of their productiveness at the Central Experimental Farm. The number of days required for each sort, from sowing to ripening, is also given and thus their relative earliness is shown.

In comparing the results obtained from the several varieties in any one year with another, the relative positions occupied by the different sorts will often vary from lack of uniformity in the soil and other causes. When, however, the average of a series of results can be given covering a number of years, the evidence is much more satisfactory and valuable.

In the summary given near the end of this bulletin the average crops obtained from the sowings of seven successive years are shown. On comparing the crops of the past year with the average of the previous five and six years, it will be seen that the results of the harvest of 1901 have on the whole been very satisfactory. The best twelve yielding oats on the Central Farm, owing to unfavourable conditions of

weather, average nearly nine bushels less per acre than the average of past years. At the Experimental Farm at Nappan the yield for 1901 is about one and a half bushels less. At Brandon the yield has been considerably above the average, while at Indian Head the crop has been a phenomenal one. The average given at this farm by the best twelve sorts for the five years previous was 83 bushels 13 lbs. per acre, the record for 1901 is an average of 132 bushels 27 lbs., or more than 49 bushels over the previous average. At Agassiz, B.C., the crop has also been unusually large, having exceeded the average of the previous six years by over 36 bushels. In barley the crops at Ottawa, Nappan and Brandon have been above the average and largely so at Indian Head and Agassiz. In spring wheat the average has been exceeded at all the farms and has been very much above the average at Indian Head and Agassiz. Pease show a falling off at Ottawa and Brandon and increases at Nappan, Indian Head and Agassiz. Indian corn is well above the average throughout, except at Agassiz, where it falls below. The yield of turnips, mangels, carrots and sugar beets are good and all considerably above the average, excepting at Agassiz, where the yield of mangels, carrots and sugar beets fall below the usual return.

In potatoes there has been a considerable increase in the crops at Ottawa and Nappan, and remarkable increases at Brandon, Indian Head and Agassiz.

By the issue of this publication early in the season the farmers of Canada are advised as to the relative productiveness and earliness of each sort at the several experimental farms before making their selection of seed for sowing during the approaching season.

TRIAL PLOTS OF OATS.

In arranging the uniform trial plots of oats from year to year the number of varieties under test have been reduced during the past two or three years by omitting those which during a period of five years have not at any time found their way into the list of the twelve most productive sorts at any of the experimental farms. The names of the varieties discontinued either on this account or from weakness of straw or other defects, are the following eighteen sorts :—Coulommiers, Doncaster Prize, Early Dawson, Early Etampes, Giant Cluster, Imported Irish, Medal, Mortgage Lifter, Poland, Prize Cluster, Rennie's Prize White, Scottish Chief, Scotch Hopetown, Victoria Prize, Welcome, White Wonder, White Monarch, Winter Grey.

Some additions of new kinds have been made to the list, among them four of the new varieties of oats recently introduced into cultivation by the Garton Bros. Seed Co., of Newton-le-Willows, England, namely, Waverley, Tartar King, Goldfinder and Pioneer. Among other recent additions to the list are Loughoughton, Salzer's Big Four, Scotch Potato and Sensation. The Garton Bros.' oats have not given as good crops as was looked for, but they are very promising and it is expected they will do better after a year or two when they become more acclimatized.

There are included in the sixty-four varieties under trial during 1901 the following cross-bred oats which have been originated at the experimental farms :—Cromwell, Holland, Olive, Oxford, Pense, Miller, Brandon, Milford, King, Kendal, Master and Russell. At the farms at Ottawa, Ont., Nappan, N.S., and Agassiz, B.C., the size

of the plots on which these oats were sown was one-fortieth of an acre each, and at Brandon, Man., and Indian Head, N.W.T., they were one-twentieth of an acre. The quantity of seed sown of each sort was in the proportion of two bushels per acre, and the dates of sowing were as follows :—At Ottawa most of them were sown on April 17, a few were sown later ; Nappan, May 1 ; Brandon, May 10 to 13 ; Indian Head, May 9 ; and at Agassiz, April 18.

Particulars as to the character of the land in each case, and of the preparation and treatment it has had, will be found in the Annual Report of the Experimental Farms for the year 1901.

UNIFORM TEST PLOTS OF OATS.

Number.	Name of Variety.	Yield per Acre at the several Experimental Farms, Season of 1899.												Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.		Nappan, N. S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	Cromwell	58	8	74	4	65	10	102	12	68	8	73	22	100	107	101	105	120	106⅘
2	Joanette	57	2	62	12	68	28	114	24	67	2	74	..	103	101	110	107	118	107⅘
3	Columbus	57	2	55	10	84	4	120	..	65	30	76	16	101	109	99	104	120	106⅘
4	Milford	57	2	60	..	31	6	102	32	72	12	64	24	96	107	99	106	120	105⅘
5	Kendal	55	30	61	6	70	20	108	28	66	6	72	18	100	107	110	108	120	109
6	Early Maine	55	10	62	12	91	26	124	4	66	16	80	..	100	108	102	99	118	105⅘
7	American Triumph	54	24	58	28	87	2	119	14	86	26	83	12	100	113	101	99	125	107⅘
8	Olive	54	24	58	28	70	..	111	26	85	10	76	4	96	107	109	105	120	107⅘
9	Improved American	54	24	65	30	90	..	135	30	70	20	83	14	100	109	102	101	120	106⅘
10	Lincoln	54	24	64	24	85	30	130	20	94	24	86	4	100	109	101	99	120	105⅘
11	Mennonite	54	24	63	18	80	..	134	4	68	8	80	4	98	109	101	102	118	105⅘
12	Black Beauty	53	18	65	30	57	22	109	14	101	6	77	18	95	100	108	102	124	105⅘
13	Oxford	51	26	51	26	65	30	80	..	80	..	65	30	100	109	102	104	120	107
14	Abundance	51	6	62	12	83	18	147	2	80	..	84	28	100	107	102	101	120	106
15	Pense	50	..	64	24	59	14	107	22	74	4	71	6	96	107	110	106	118	107⅘
16	California Prolific Blk.	50	..	58	28	69	14	112	32	81	26	74	20	103	109	110	103	123	109⅘
17	Banner	48	28	63	18	85	10	129	14	77	12	80	30	100	107	103	104	118	106⅘
18	Holstein Prolific	48	28	57	22	81	26	118	8	94	4	80	4	100	106	102	99	124	106⅘
19	Prolific Blk. Tartarian	48	28	63	18	60	20	114	24	77	2	72	32	103	109	107	105	118	108⅘
20	American Beauty	48	8	68	8	79	14	137	2	72	22	81	4	98	109	99	102	120	105⅘
21	Irish Victor	48	8	57	22	84	24	87	2	*		69	14	100	106	99	105	....	102⅘
22	Sensation	47	22	58	28	75	10	97	22	63	18	68	20	100	102	102	103	118	105
23	Thousand Dollar	47	22	60	..	68	8	138	28	71	6	77	6	98	107	102	101	120	105⅘
24	Russell	47	22	47	2	71	6	95	10	88	8	69	30	100	107	104	102	124	107⅘
25	Cream Egyptian	47	22	76	16	72	12	96	16	91	6	76	28	100	107	90	94	124	103
26	Rosedale	47	2	71	26	76	16	111	26	67	32	75	..	103	101	104	103	120	106⅘
27	Salzer's Big Four	47	2	56	16	60	20	†		91	26	63	33	98	105	91	†	125	104⅘
28	White Schonen	46	16	68	8	87	2	97	2	93	18	78	16	100	106	101	97	120	104⅘
29	Master	46	16	47	2	66	16	90	20	87	22	67	22	103	100	102	106	126	109⅘
30	Hazlett's Seizure	46	16	63	18	81	6	101	26	91	26	76	32	100	101	93	95	124	102⅘
31	Buckbee's Illinois	45	10	62	12	73	18	115	30	95	10	78	16	100	109	106	100	124	107⅘
32	Golden Beauty	45	10	60	..	88	28	126	16	77	22	79	20	100	109	104	101	125	107⅘
33	Oderbruch	44	4	68	8	71	26	119	14	86	16	78	..	103	107	104	102	120	107⅘
34	Improved Ligowo	44	4	60	..	81	6	125	30	78	18	77	32	98	106	99	98	124	105
35	Danish Island	44	4	57	22	89	14	128	8	91	6	82	4	101	109	101	100	126	107⅘
36	White Giant	44	4	63	18	89	14	91	26	82	12	74	8	101	107	103	98	120	105⅘

* Not sown at Agassiz.
† Not sown at Indian Head.

UNIFORM TEST PLOTS OF OATS—*Concluded.*

Number.	Name of Variety.	Yield per Acre at the several Experimental Farms, Season of 1899.												Number of Days from Sowing to Harvesting.					
		Ottawa.		Nappan, N.S.		Brandon, Man.		Agassiz, B.C.		Indian Head, N.W.T.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
37	Newmarket	44	4	63	18	68	8	124	24	62	12	72	20	100	109	102	100	120	106½
38	Early Gothland	44	4	58	28	75	10	119	14	89	4	77	12	101	107	104	102	120	106½
39	King	43	28	54	4	65	30	110	..	90	..	72	26	100	107	105	98	125	107
40	New Zealand	42	12	49	14	78	8	105	10	78	8	70	21	113	113	105	108	120	111½
41	Wide Awake	41	26	56	16	89	14	129	14	100	..	83	14	100	109	103	99	123	106½
42	Holland	41	26	47	2	67	22	105	10	97	2	71	26	103	109	110	104	124	110
43	Pioneer	41	26	57	22	61	26	104	24	75	.	68	6	100	109	101	106	118	106½
44	Early Blossom	41	26	62	12	74	24	121	26	87	2	77	18	103	107	104	104	118	107½
45	Bavarian	40	20	65	30	84	4	117	22	71	26	76	..	100	109	101	100	118	105½
46	Abyssinia	40	20	68	8	70	20	119	14	89	4	77	20	103	108	102	103	125	108½
47	Wallis	40	20	61	6	86	16	121	6	68	28	75	22	98	109	103	103	118	106½
48	Salines	40	20	44	24	63	18	96	16	92	32	67	22	104	108	105	105	120	108½
49	Flying Scotchman	40	..	67	2	57	22	103	18	70	..	67	22	97	101	99	95	118	102
50	Goldfinder	39	14	55	10	73	18	116	16	73	8	71	20	103	109	110	109	124	111
51	Miller	39	14	56	16	70	..	95	10	67	32	65	28	106	109	104	98	120	107½
52	Black Mesdag	37	22	65	30	64	24	87	2	72	12	65	18	95	97	94	96	112	98½
53	Brandon	37	2	48	8	62	12	92	32	89	14	66	..	103	109	103	98	120	106½
54	White Russian	37	2	62	12	69	14	113	18	85	30	73	22	100	105	101	102	120	105½
55	Siberian	34	24	65	30	88	28	120	..	74	4	76	24	103	109	101	104	124	108½
56	Bonanza	33	18	61	6	69	14	72	32	77	22	62	32	97	101	89	95	125	101½
57	Golden Giant	32	12	57	22	70	..	108	28	72	32	68	12	103	113	106	106	120	109½
58	Early Archangel	32	12	60	..	73	18	111	26	81	6	71	26	98	99	101	96	125	103½
59	Early Golden Prolific	32	12	67	2	67	2	127	2	93	8	77	12	100	101	104	98	123	105½
60	Tartar King	31	6	60	..	58	28	98	28	80	20	65	30	98	101	101	105	124	105½
61	Golden Tartarian	31	6	60	..	82	32	99	14	103	18	75	14	106	113	106	103	124	110½
62	Waverley	30	..	51	26	78	8	97	2	68	18	65	4	100	107	104	104	118	106½
63	Longhoughton	20	20	44	24	*	..	81	6	69	14	53	33	103	109	....	109	124	111½
64	Scotch Potato	20	20	58	28	45	10	94	24	78	28	59	22	103	107	105	106	124	109

* Destroyed by cut-worms.

The twelve varieties of oats which have produced the largest crops during 1901 at the several experimental farms are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Cromwell	58	8	7. American Triumph	54	24
2. Joanette	57	2	8. Olive	54	24
3. Columbus	57	2	9. Improved American	54	24
4. Milford	57	2	10. Lincoln	54	24
5. Kendal	55	30	11. Mennonite	54	24
6. Early Maine	55	10	12. Black Beauty	53	18

An average crop of 55 bushels 22 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Cream Egyptian	76	16	7. White Schonen	68	8
2. Cromwell	74	4	8. Early Golden Prolific	67	2
3. Rosedale	71	26	9. Flying Scotchman	67	2
4. Abyssinia	68	8	10. Bavarian	65	30
5. American Beauty	68	8	11. Improved American	65	30
6. Oderbruch	68	8	12. Black Mesdag	65	30

An average crop of 68 bushels 31 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Early Maine	91	26	7. Siberian	88	28
2. Improved American	90	..	8. American Triumph	87	2
3. White Giant	89	14	9. White Schonen	87	2
4. Danish Island	89	14	10. Wallis	86	16
5. Wide Awake	89	14	11. Lincoln	85	30
6. Golden Beauty	88	28	12. Banner	85	10

An average crop of 88 bushels 10 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Abundance	147	2	7. Banner	129	14
2. Thousand Dollar	138	28	8. American Triumph	129	14
3. American Beauty	137	2	9. Wide Awake	129	14
4 Improved American	135	30	10. Danish Island	128	8
5. Mennonite	134	4	11. Early Golden Prolific	127	2
6. Lincoln	130	20	12. Golden Beauty	126	16

An average crop of 132 bushels 27 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Golden Tartarian	103	18	7. White Schonen	93	18
2. Black Beauty	101	6	8. Early Golden Prolific	93	8
3. Wide Awake	100	..	9. Salines	92	32
4. Holland	97	2	10. Hazlett's Seizure	91	26
5. Buckbee's Illinois	95	10	11. Salzer's Big Four	91	26
6. Lincoln	94	24	12. Cream Egyptian	91	6

An average crop of 95 bushels 17 lbs. per acre.

The twelve varieties of oats which have produced the largest crops in 1901, taking the average results obtained on all the experimental farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Lincoln	86	4	7. American Beauty	81	4
2. Abundance	84	28	8. Banner	80	30
3. Improved American	83	14	9. Holstein Prolific	80	4
4. Wide Awake	83	14	10. Mennonite	80	..
5. American Triumph	83	12	11. Early Maine	80	..
6. Danish Island	82	4	12. Golden Beauty	79	20

An average crop of 82 bushels 3 lbs. per acre.

The average crop of all the varieties of oats tested at each of the experimental farms in 1901 was as follows :—At Ottawa, 44 bushels 12 lbs. per acre ; Nappan, 60 bushels 7 lbs.; Brandon, 72 bushels 8 lbs.; Indian Head, 109 bushels 8 lbs.; and at Agassiz, 80 bushels 15 lbs. The average return given by the whole of the varieties of oats tested at all the farms was 73 bushels 10 lbs. per acre.

TRIAL PLOTS OF BARLEY.

During the season of 1901 fifty-one varieties of barley have been under test, twenty-one of which were two-rowed sorts and thirty six-rowed. Among the two-rowed sorts there were twelve hybrid varieties which have been produced at the experimental farms : Beaver, Bolton, Clifford, Dunham, Fulton, Harvey, Jarvis, Leslie, Logan, Nepean, Sidney and Victor. Among the six-rowed sorts there are seventeen of these hybrids, namely, Albert, Argyle, Brome, Claude, Empire, Garfield, Mansfield, Nugent, Phœnix, Pioneer, Stella, Success, Summit, Surprise, Trooper, Vanguard and Yale.

The barley plots were the same size as those sown with oats. Two bushels of seed was used in each case, and the dates of sowing were as follows :—At Ottawa, six-rowed, April 19 ; two-rowed, April 26 ; Nappan all May 11 ; Brandon May 17 and 18 ; Indian Head, May 14, and at Agassiz on April 17.

UNIFORM TEST PLOTS OF TWO-ROWED BARLEY.

Number.	Name of Variety.	Yield per acre at the several Experimental Farms for Season of 1901.						Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B. C.	Average of all Farms.	Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush. Lbs.	Bush. Lbs.	Bush. Lbs.	Bush. Lbs.	Bush. Lbs.	Bush. Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	French Chevalier	55 10	52 24	23 36	57 44	51 42	48 12	90	95	97	102	118	100¾
2	Danish Chevalier	47 4	38 16	19 8	57 4	47 4	41 36	93	96	96	102	115	100¾
3	Beaver	46 2	56 32	18 36	36 32	61 2	43 40	85	91	96	89	112	94½
4	Canadian Thorpe	45 10	44 8	27 14	50 40	50 20	43 28	88	96	95	100	115	98½
5	Standwell	42 34	45 ..	30 20	67 44	55 40	48 18	88	96	96	101	117	99½
6	Clifford	41 42	33 16	39 8	54 8	46 22	43 ..	88	95	91	84	111	93½
7	Nepean	41 2	37 24	31 32	58 16	52 24	44 10	88	96	93	91	115	96¾
8	Logan	39 18	35 40	35 20	54 28	51 12	43 14	88	96	96	89	111	96
9	Kinver Chevalier	36 22	33 16	17 24	55 40	50 40	38 38	90	96	97	103	117	100¾
10	Gordon	33 46	36 32	43 36	52 24	46 38	42 35	85	95	95	88	113	95½
11	Jarvis	31 42	27 24	47 44	57 4	50 40	43 2	83	95	91	85	111	93
12	Sidney	31 22	38 16	25 40	61 32	37 44	39 2	87	96	90	87	117	95¾
13	Prize Prolific	31 12	42 24	24 8	56 32	59 8	42 36	93	95	96	102	119	101
14	Dunham	30 30	30 40	41 32	45 20	50 ..	39 34	85	96	91	86	112	94
15	Invincible	29 28	35 40	29 8	55 40	34 8	36 44	93	95	95	99	118	100
16	Bolton	25 10	45 ..	26 12	59 28	50 40	41 18	94	91	90	92	112	95¾
17	Victor	21 4	30 40	27 44	47 4	45 40	34 34	88	96	92	92	115	96¾
18	Fulton	20 10	30 ..	36 12	50 40	38 16	35 6	90	96	94	88	112	96
19	Harvey	14 38	36 32	42 24	57 24	51 2	40 24	97	96	94	83	111	96½
20	Leslie	11 2	39 8	35 20	58 36	52 46	39 [illegible]	97	96	93	83	115	96¾
21	Newton	*	45 ..	19 28	55 20	51 42	42 46	..	96	97	101	113	101¾

* Not grown at Ottawa.

The six varieties of two-rowed barley which have given the largest crops during 1901 at the several experimental farms are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. French Chevalier	57	44	4. Canadian Thorpe	45	10
2. Danish Chevalier	57	4	5. Standwell	42	34
3. Beaver	46	2	6. Clifford	41	42

An average crop of 48 bushels 23 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Beaver	56	32	4. Newton	45	..
2. French Chevalier	52	24	5. Standwell	45	..
3. Bolton	45	..	6. Canadian Thorpe	44	8

An average yield of 48 bushels 3 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Jarvis	47	44	4. Dunham	41	32
2. Gordon	43	36	5. Clifford	39	8
3. Harvey	42	24	6. Fulton	36	12

An average yield of 41 bushels 42 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Standwell	67	44	4. Leslie	58	36
2. Sidney	61	32	5. Nepean	58	16
3. Bolton	59	28	6 French Chevalier	57	44

An average yield of 60 bushels 33 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Beaver	61	2	4. Leslie	52	46
2. Prize Prolific	59	8	5. Newton	51	42
3. Standwell	55	40	6. Logan	51	12

An average crop of 55 bushels 17 lbs. per acre.

The six varieties of two-rowed barley which have produced the largest crops in 1901, taking the average results obtained on all the experimental farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Standwell	48	18	4. Beaver	43	40
2. French Chevalier	48	12	5 Canadian Thorpe	43	28
3. Nepean	44	10	6. Logan	43	14

An average crop of 45 bushels 12 lbs. per acre.

The average crop of all the varieties of two-rowed barley tested at each of the experimental farms in 1901 was as follows :—At Ottawa, 33 bushels 40 lbs. per acre ; Nappan, 38 bushels 39 lbs.; Brandon, 30 bushels 31 lbs.; Indian Head, 54 bushels 40 lbs.; and at Agassiz, 49 bushels 18 lbs. The average return given by the whole of the varieties of two-rowed barley tested at all the farms was 41 bushels 24 lbs. per acre.

UNIFORM TEST PLOTS OF SIX-ROWED BARLEY.

Number.	Name of Variety.	Yield per Acre at the several Experimental Farms for Season of 1901.												Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	Odessa	41	2	60	..	26	32	68	36	59	8	51	6	90	88	93	93	113	95¾
2	Mensury	39	8	56	32	48	16	67	4	59	28	54	8	83	88	95	92	110	93¾
3	Stella	36	42	38	16	21	32	51	12	47	14	39	4	90	96	95	91	113	97
4	Claude	36	42	52	24	38	36	66	12	60	40	51	2	90	88	95	89	112	94¼
5	Royal	33	26	41	32	33	36	63	16	67	24	47	46	90	89	91	90	110	94
6	Nugent	33	6	47	24	33	36	55	40	61	12	46	14	90	89	94	100	113	97¼
7	Blue Long-head	31	42	33	16	33	16	57	4	57	4	42	26	89	89	95	90	112	96¼
8	Rennie's Improved	29	18	46	32	32	4	52	24	51	28	43	2	90	87	92	87	110	93½
9	Petschora	27	34	46	32	41	32	59	8	55	20	46	6	89	88	91	88	108	92¾
10	Pioneer	27	34	44	8	27	24	54	8	52	16	41	8	94	88	90	98	110	96
11	Vanguard	27	34	47	24	29	28	45	40	47	14	39	28	90	89	89	87	110	93
12	Albert	26	42	50	..	44	8	45	40	54	28	44	14	89	86	87	88	113	92¾
13	Garfield	26	22	45	40	46	12	53	16	47	4	43	38	92	88	95	92	112	95¼
14	Yale	26	2	50	40	47	4	48	36	58	36	46	14	94	93	91	92	113	96¾
15	Oderbruch	26	2	61	32	29	28	53	16	51	44	44	24	92	88	92	85	107	92½
16	Common	26	2	64	8	29	8	53	36	60	40	46	38	89	86	89	89	113	93½
17	Trooper	25	10	41	32	29	8	59	28	50	40	41	14	91	91	95	89	113	95¾
18	Summit	25	10	40	40	37	24	56	12	47	4	41	18	90	96	91	99	111	97¾
19	Phœnix	25	10	42	24	44	8	40	..	52	46	40	46	90	88	87	87	110	92¾
20	Baxter	24	18	59	8	37	24	50	..	55	32	44	45	89	88	91	87	108	92¾
21	Empire	22	34	46	32	33	16	56	32	58	26	43	28	90	89	95	93	111	95¾
22	Argyle	21	42	48	16	43	36	44	8	58	16	43	14	90	88	91	88	113	94
23	Champion	.....		47	24	30	40	47	4	51	4	44	6	....	86	88	85	107	91¾
24	Mansfield	.....		40	..	47	24	57	4	59	18	50	48	....	93	87	92	115	96¾
25	Excelsior	.....		50	..	40	40	..	..	54	28	48	23	....	86	87	....	107	93¾
26	Surprise	.....		40	..	32	4	46	12	45	40	41	2	....	96	94	92	113	98¾
27	Brome	.....		45	..	27	44	58	16	52	16	45	43	....	93	95	91	113	98
28	Hulless Black	.....		50	40	36	32	45	40	45	20	44	44	....	86	93	85	110	93¾
29	Hulless White	.....		46	32	16	12	37	4	45	..	36	12	....	86	87	84	110	91¾
30	Success	.....		49	8	29	28	41	12	50	30	42	31	....	86	93	85	107	92¾

* Eight varieties of six-rowed barley were sown at the Central Experimental Farm in a hollow place where they were injured by water so as to make the results unreliable.

The six varieties of six-rowed barley which have given the largest crops during 1901 at the several experimental farms are the following—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Odessa	41	2	4. Claude	36	42
2. Mensury	39	8	5. Royal	33	26
3. Stella	36	42	6. Nugent	33	6

An average crop of 36 bushels 37 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Common	64	8	4 Baxter	59	8
2 Oderbruch	61	32	5. Mensury	56	32
3. Odessa	60	..	6. Claude	52	24

An average crop of 59 bushels 1 lb. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury	48	16	4. Garfield	46	12
2. Mansfield	47	24	5. Phœnix	44	8
3. Yale	47	4	6. Albert	44	8

An average crop of 46 bushels 12 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Odessa	68	36	4. Royal	63	16
2. Mensury	67	4	5. Trooper	59	28
3. Claude	66	12	6. Petschora	59	8

An average crop of 64 bushels 1 lb. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Royal	67	24	4. Common	60	40
2. Nugent	61	12	5. Mensury	59	28
3. Claude	60	40	6. Mansfield	59	18

An average crop of 61 bushels 27 lbs. per acre.

The six varieties which have produced the largest crops in 1901, taking the average of the results obtained on all the experimental farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury	54	8	4. Mansfield	50	48
2. Odessa	51	6	5. Excelsior	48	23
3. Claude	51	2	6. Royal	47	46

An average crop of 50 bushels 30 lbs. per acre.

The average crop of all the varieties of six-rowed barley tested at each of the experimental farms in 1901 was as follows :—At Ottawa, 29 bushels 7 lbs. per acre ; Nappan, 47 bushels 41 lbs.; Brandon, 35 bushels 1 lb.; Indian Head, 52 bushels 46 lbs., and at Agassiz, 54 bushels 2 lbs. The average returns given by the whole of the varieties of six-rowed barley tested at all the farms was 44 bushels 29 lbs. per acre.

TRIAL PLOTS OF SPRING WHEAT.

Seventy-one varieties of spring wheat were grown on the uniform trial plots during 1901. Among the new sorts added to the list this year are four promising kinds received under numbers from Prof. Wm. Hays, of St. Anthony's Park, Minnesota, a number of varieties from Australia and eight cross-bred sorts which have been produced at the experimental farms. The cross-bred sorts now under test in these trial plots number thirty-eight in all, as follows :—Admiral, Advance, Alpha, Angus, Beauty, Benton, Bishop, Blair, Blenheim, Byron, Captor, Cartier, Cassel, Chester, Clyde, Countess, Crawford, Crown, Dawn, Dufferin, Early Riga, Ebert, Essex, Fraser, Harold, Hastings, Huron, Laurel, Mason, Norval, Percy, Plumper, Preston, Progress, Rideau, Stanley, Weldon and Vernon.

The size of the plots was one-fortieth of an acre each at Ottawa, Nappan and Agassiz, and one-twentieth of an acre at Brandon and Indian Head, and the quantity of seed sown was in the proportion of one and one-half bushels per acre. The dates of sowing were as follows :—At Ottawa, April 18 ; Nappan, May 1 ; Brandon, May 2 and 3 ; Indian Head, May 7, and at Agassiz, April 16 to 22.

UNIFORM TEST PLOTS OF SPRING WHEAT.

Number.	Name of Variety.	Yield per Acre at the several Experimental Farms Season of 1901.												Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	Goose	33	50	26	..	42	..	63	..	37	40	40	30	110	112	112	114	126	114½
2	Hastings	33	50	34	40	20	40	57	20	50	..	39	18	101	112	109	109	119	110
3	Huron	32	..	25	20	35	20	66	40	44	20	40	44	104	111	107	108	125	111
4	Herisson Bearded	32	..	32	..	26	40	57	20	37	..	37	..	105	111	105	113	125	111½
5	White Fife	31	10	30	..	34	20	52	..	40	..	37	30	110	113	109	104	123	111½
6	Beaudry	29	50	34	40	25	40	60	40	31	..	36	22	110	109	103	110	123	111
7	Australian No. 19	29	10	20	..	18	..	56	40	45	20	33	50	112	118	112	108	119	113½
8	Red Fife	29	10	27	20	36	40	57	..	40	30	38	8	109	111	111	110	123	112½
9	Hungarian	29	10	34	..	29	40	56	40	44	40	38	50	105	111	109	111	126	112½
10	Preston	28	40	33	20	31	..	57	20	44	..	38	52	104	110	106	114	123	111½
11	Minnesota No. 181	28	40	29	20	25	..	60	..	43	..	37	12	105	113	112	110	126	113½
12	Beauty	28	30	24	40	35	40	58	40	42	..	37	54	111	113	111	105	123	112½
13	Dion's	27	50	26	40	27	20	59	20	36	40	35	34	111	111	108	108	123	112½
14	White Chaff, Campbell's	27	50	30	..	33	..	56	..	38	10	37	..	106	110	108	108	125	111½
15	Plumper	27	20	32	40	31	20	51	..	41	20	36	44	104	111	110	107	126	111½
16	Australian No. 13	27	10	24	..	36	..	66	40	39	40	38	42	113	118	111	109	115	113½
17	Australian No. 10	26	30	27	20	25	20	48	40	40	40	33	42	111	118	112	108	116	113
18	Clyde	26	30	34	..	36	40	60	40	36	..	38	46	104	112	102	102	126	109½
19	Crown	26	30	34	40	38	..	50	..	39	40	37	46	105	112	106	109	125	111½
20	Rio Grande	25	10	30	40	33	..	62	..	35	40	37	18	111	111	107	114	122	113
21	Blenhein	24	40	28	40	32	20	54	..	38	..	35	32	105	111	106	111	123	111½
22	Percy	24	..	30	..	29	20	57	20	37	..	35	32	104	111	99	103	123	108
23	Chester	23	50	30	40	19	20	50	40	49	20	34	46	105	112	111	108	117	110½
24	Minnesota, No. 169	23	20	22	40	32	40	57	20	46	40	36	32	106	113	111	111	125	113½

UNIFORM TEST PLOTS OF SPRING WHEAT—*Concluded.*

Number.	Name of Variety.	Yield per Acre at the several Experimental Farms Season of 1901.												Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
25	Pringle's Champlain	23	20	30	..	29	20	56	40	42	20	36	20	104	110	106	111	125	111½
26	Minnesota, No. 163	23	20	30	..	34	..	58	..	38	40	36	48	106	113	111	109	126	113
27	Wellman's Fife	23	10	28	40	34	40	57	40	36	20	36	6	110	113	109	109	125	113½
28	Australian, No. 27	23	10	24	40	17	20	58	..	39	40	32	34	110	118	110	106	117	112½
29	Cartier	23	10	24	40	28	..	44	40	48	40	33	50	105	112	102	106	117	108½
30	Roumanian	23	10	40	..	35	40	57	20	52	..	41	38	111	113	112	112	126	114½
31	Early Riga	22	40	26	40	27	20	49	..	46	20	34	24	94	107	96	98	118	102½
32	Red Fern	22	30	32	40	28	..	57	20	40	40	36	14	106	111	110	113	126	113½
33	Colorado	22	..	34	..	31	20	58	20	44	40	38	4	105	110	106	113	122	111½
34	Dawn	22	..	26	..	33	20	61	..	39	20	36	20	104	111	101	105	123	108½
35	Captor	22	..	23	20	18	..	50	20	47	..	32	8	105	113	103	108	125	110½
36	Rideau	22	..	28	40	33	..	62	40	36	20	36	32	105	112	105	107	119	109½
37	Australian, No. 23	21	50	22	40	19	20	58	40	46	30	33	48	111	118	111	108	118	113½
38	Speltz	21	50	28	..	45	20	58	20	39	30	38	36	111	113	108	102	104	107½
39	Laurel	21	10	30	..	35	..	54	..	45	20	37	6	112	113	111	111	126	114½
40	White Connell	21	10	34	..	34	..	55	20	37	40	36	26	112	113	111	109	126	114½
41	White Russian	21	10	33	20	36	..	54	..	38	..	36	30	111	113	111	105	126	113½
42	Admiral	21	10	33	20	37	20	56	20	41	20	37	54	112	112	108	108	125	113
43	Alpha	20	40	33	20	35	..	53	40	46	40	37	52	105	112	103	110	125	111
44	Robin's Rust Proof	20	40	20	40	26	..	49	20	43	20	32	..	112	113	111	112	117	113
45	Benton	20	40	20	..	33	20	49	20	44	30	33	34	105	113	103	108	116	109
46	Advance	20	40	35	20	34	20	57	..	43	20	38	8	104	109	103	110	118	108½
47	Monarch	20	30	30	40	36	20	57	40	37	20	36	30	110	113	109	110	126	113½
48	Blair	20	..	32	40	30	20	55	..	51	10	37	50	105	113	112	104	125	111½
49	Countess	20	..	28	40	26	20	65	20	50	40	38	12	106	113	111	103	123	111½
50	Red Swedish	19	50	30	..	24	20	49	..	42	20	33	6	111	110	109	114	123	113½
51	Progress	19	50	25	20	37	..	54	..	39	10	35	4	101	112	106	105	125	109½
52	Australian, No. 25	19	50	26	40	21	20	54	..	44	40	33	18	111	118	112	107	117	113
53	Minnesota, No. 149	19	40	22	..	33	40	59	20	41	40	35	16	106	113	112	109	126	113½
54	Harold	19	40	30	40	23	20	48	..	35	20	31	24	94	111	107	100	116	105½
55	Australian, No, 9	19	30	20	..	30	..	50	40	48	40	33	46	106	118	109	107	118	111½
56	Stanley	19	20	30	40	36	..	61	40	50	40	39	40	104	112	106	105	126	110½
57	Norval	19	20	34	..	34	40	45	40	38	20	34	24	101	111	101	104	116	106½
58	Dufferin	19	10	24	40	30	40	58	..	46	10	35	44	105	112	103	111	118	109½
59	Essex	19	10	24	40	24	..	61	20	47	20	35	18	112	113	109	109	119	112½
60	Crawford	19	.	26	40	28	..	55	..	47	20	35	12	101	112	105	99	119	107½
61	Fraser	18	40	26	40	27	20	52	..	41	40	33	16	95	111	105	100	118	105½
62	Angus	18	40	24	40	30	40	46	..	39	40	31	56	105	112	106	110	117	110
63	Weldon	18	40	35	20	31	40	57	40	41	20	36	56	105	113	111	102	122	110½
64	Byron	17	50	30	..	30	40	43	40	34	..	31	14	104	113	107	103	119	109½
65	Japanese	17	20	32	40	16	40	56	40	40	10	32	42	97	112	99	108	119	107
66	Cassel	17	10	26	..	20	40	54	..	44	50	32	32	112	112	112	108	121	113
67	Vernon	17	10	33	20	35	40	59	20	44	40	38	2	105	110	110	111	119	111
68	Mason	16	40	32	..	31	..	67	..	40	20	37	24	105	112	105	104	125	110½
69	Ebert	15	20	26	40	28	.	50	20	51	30	34	22	95	112	102	99	120	105½
70	Ladoga	14	40	26	40	27	..	55	40	41	20	33	4	100	108	105	107	118	107½
71	Bishop	13	50	26	..	24	40	52	..	42	..	31	42	105	113	106	106	120	110

The twelve varieties of spring wheat which have given the largest crops at the several experimental farms in 1901 are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Goose	33	50	7. Australian, No. 19	29	10
2. Hastings	33	50	8. Red Fife	29	10
3. Huron	32	..	9. Hungarian	29	10
4. Herisson Bearded	32	..	10. Preston	28	40
5. White Fife	31	10	11. Minnesota, No. 181	28	40
6. Beaudry	29	50	12. Beauty	28	30

An average crop of 30 bushels 30 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian	40	..	7. Hungarian	34	..
2. Weldon	35	20	8. Colorado	34	..
3. Advance	35	20	9. White Connell	34	..
4. Hastings	34	40	10. Norval	34	..
5. Beaudry	34	40	11. Clyde	34	..
6. Crown	34	40	12. Preston	33	20

An average crop of 34 bushels 50 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Goose	42	..	7. Monarch	36	20
2. Crown	38	..	8. Stanley	36	..
3. Admiral	37	20	9. White Russian	36	..
4. Progress	37	..	10. Australian, No. 13	36	..
5. Clyde	36	40	11. Vernon	35	40
6. Red Fife	36	40	12. Beauty	35	40

An average crop of 36 bushels 57 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mason	67	..	7. Rio Grande	62	..
2 Huron	66	40	8. Stanley	61	40
3. Australian, No. 13	66	40	9. Essex	61	20
4. Countess	65	20	10. Dawn	61	..
5. Goose	63	..	11. Clyde	60	40
6. Rideau	62	40	12. Beaudry	60	40

An average crop of 63 bushels 13 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian	52	..	7. Chester	49	20
2. Ebert	51	30	8. Cartier	48	40
3. Blair	51	10	9. Australian, No. 9	48	40
4. Stanley	50	40	10. Essex	47	20
5. Countess	50	40	11. Crawford	47	20
6. Hastings	50	..	12. Captor	47	..

An average crop of 49 bushels 32 lbs. per acre.

The twelve varieties of spring wheat which have given the largest crops in 1901, taking the average of the results obtained on all the experimental farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian	41	38	7. Hungarian	38	50
2. Huron	40	44	8. Clyde	38	46
3. Goose	40	30	9. Australian, No. 13	38	42
4 Stanley	39	40	10. Speltz	38	36
5. Hastings	39	18	11. Countess	38	12
6. Preston	38	52	12. Red Fife	38	8

An average crop of 39 bushels 20 lbs. per acre.

The average crop of all the varieties of spring wheat, tested at each of the experimental farms in 1901, was as follows :—At Ottawa, 22 bushels 50 lbs. per acre ; Nappan, 28 bushels 53 lbs.; Brandon, 30 bushels 9 lbs.; Indian Head, 55 bushels 49 lbs., and Agassiz, 42 bushels 14 lbs. The average return given by the whole of the varieties of spring wheat at all the farms was 35 bushels 59 lbs. per acre.

TRIAL PLOTS OF PEASE.

The varieties of pease under test in 1901 in the uniform trial plots numbered fifty-seven. Among these there are thirty cross-bred sorts which have been originated at the experimental farms. These are Agnes, Alma, Archer, Arthur, Bedford, Bright, Bruce, Carleton, Chelsea, Cooper, Dover, Duke, Elder Elliot, Fenton, Fergus, Gregory, Herald, Kent, King, Lanark, Mackay, Macoun, Nelson, Pearl, Perth, Picton, Prince, Trilby and Vincent. These were sown in plots of one-fortieth of an acre each at Ottawa, Nappan and Agassiz, and one-twentieth of an acre at Brandon and Indian Head. The quantity of seed used per acre has varied from two to three bushels, depending on the size of the pea. The dates of sowing were as follows :—Ottawa, April 29 ; Nappan, May 2 ; Brandon, May 4 to 8 ; Indian Head, May 15, and at Agassiz, April 15.

UNIFORM TEST PLOTS OF PEASE.

Number.	Name of Variety.	Yield per Acre at the several Experimental Farms Season of 1901.												Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	Cooper	33	20	41	20	36	..	50	40	47	10	41	42	108	113	122	115	130	117½
2	English Grey	32	..	36	40	29	50	48	20	64	..	42	10	108	120	127	112	128	119
3	Paragon	32	..	43	20	43	..	59	40	49	40	45	32	95	108	121	118	130	114½
4	Nelson	32	..	42	40	36	10	51	..	54	..	43	10	99	108	108	119	123	111½
5	French Canner	31	40	40	40	33	..	49	40	50	..	41	..	105	118	108	113	128	114½
6	Bruce	31	40	42	40	31	50	51	20	52	30	42	..	111	118	113	118	127	117½
7	Centennial	31	20	35	20	29	50	49	..	50	40	39	14	113	113	129	113	131	119½
8	Vincent	30	40	35	20	32	..	47	..	49	50	38	58	113	119	104	116	127	115½
9	Elder	30	40	46	40	16	30	40	20	52	40	37	22	107	121	129	118	130	121
10	Chancellor	30	40	45	20	30	40	50	..	48	..	40	56	96	107	111	107	130	110½
11	Kent	30	40	42	40	31	..	52	..	52	..	41	40	107	121	124	116	133	120½
12	Arthur	30	..	50	..	35	50	50	20	51	50	43	36	108	112	115	113	127	115
13	Victoria	30	..	48	..	41	20	45	20	47	..	42	20	114	119	126	118	127	120½
14	Carleton	30	..	36	40	34	50	50	40	52	20	40	54	107	118	124	116	130	119
15	Alma	30	..	36	40	37	20	47	40	51	20	40	36	107	108	114	116	127	114½
16	Elliot	30	..	44	40	38	30	50	20	42	20	41	10	106	118	125	118	133	120
17	King	29	20	41	20	38	50	56	..	47	20	42	34	111	113	116	109	131	116
18	Canadian Beauty	29	20	33	20	34	40	49	40	37	20	36	52	106	112	126	116	130	118
19	Picton	29	20	42	..	41	20	48	..	52	10	42	34	108	119	115	109	131	116½
20	Golden Vine	29	..	40	..	35	..	53	20	48	20	41	8	106	111	119	115	133	116½
21	Lanark	29	..	40	..	33	50	52	20	49	20	40	54	105	119	121	113	130	117½
22	Bright	28	..	46	..	25	40	46	..	39	20	37	..	109	118	128	120	133	121½
23	Bedford	28	..	25	20	30	20	43	20	44	40	34	20	108	118	119	116	131	118½
24	Large White Marrowfat	28	..	43	20	31	..	51	20	55	20	41	48	107	118	127	117	131	120
25	Perth	28	..	40	..	35	40	48	40	56	..	41	40	107	111	118	114	130	116
26	Prussian Blue	27	20	40	40	36	20	50	40	48	40	40	44	99	108	115	111	126	111½
27	Mackay	27	20	42	..	29	..	45	20	58	50	40	30	103	119	124	119	128	118½
28	Pride	27	20	46	40	34	20	60	20	59	20	45	36	105	118	119	115	130	117½
29	Mummy	27	20	36	40	39	40	50	..	44	..	39	32	108	117	122	110	131	117½
30	Pearl	27	20	50	..	27	20	46	20	48	..	39	48	114	121	126	119	130	122
31	Prince	26	40	38	..	38	..	49	40	54	..	41	16	106	108	126	111	127	115½
32	Daniel O'Rourke	26	40	38	40	29	40	59	..	48	10	40	26	98	115	116	107	122	111½
33	Creeper	26	40	38	40	31	50	47	..	48	40	38	34	105	107	103	114	122	110½
34	New Potter	26	40	42	..	41	20	51	..	57	20	43	40	113	117	130	116	128	120½
35	Wisconsin Blue	26	..	42	40	33	30	44	20	47	40	38	50	110	118	116	113	133	118
36	Duke	26	..	42	40	35	20	46	40	60	..	42	8	108	113	105	116	130	114½
37	Oddfellow	26	..	43	20	33	20	66	..	41	20	42	..	108	118	111	113	125	115
38	Agnes	26	..	44	40	33	10	53	40	56	50	42	52	107	118	119	112	131	117½
39	Black-eyed Marrowfat	25	40	38	..	30	..	50	20	47	10	38	14	112	117	105	114	127	115
40	White Wonder	25	20	41	20	33	20	57	..	54	20	42	16	100	107	108	104	131	110
41	Archer	25	..	42	..	34	20	48	20	45	20	39	..	111	113	124	116	131	119
42	Macoun	24	40	42	40	41	40	51	20	42	..	40	28	112	118	127	119	130	121½
43	Multiplier	24	40	43	20	28	40	40	40	46	30	36	46	112	118	127	113	131	120½
44	Gregory	24	40	48	40	42	30	58	40	55	..	45	54	104	118	126	113	126	117½
45	Early Britain	24	40	40	..	36	20	53	..	59	20	42	40	106	107	117	116	122	113½
46	Crown	24	20	44	..	38	30	54	20	52	30	42	44	106	115	124	114	128	117½
47	Harrison's Glory	24	..	38	..	35	..	46	..	60	40	40	44	104	108	116	118	129	115
48	Elephant Blue	24	..	40	..	28	20	52	..	57	..	40	16	106	108	127	114	126	116½
49	Prince Albert	24	..	43	20	31	..	49	20	56	40	40	52	114	117	130	113	128	120½
50	Fergus	24	..	45	20	29	40	47	40	59	..	41	8	110	121	104	116	133	116½
51	Chelsea	23	40	42	..	34	20	39	20	38	40	35	36	112	121	123	113	128	119½
52	Dover	22	40	42	40	33	..	49	..	38	40	37	12	108	119	125	116	130	119½
53	Herald	21	20	42	40	28	30	41	20	46	40	36	6	113	120	124	113	130	120
54	Fenton	20	..	36	40	36	40	54	40	40	20	37	40	103	118	119	113	123	115½
55	Trilby	19	20	37	20	32	..	53	..	52	50	38	54	105	119	127	116	127	118½
56	German White	18	20	40	..	38	40	60	..	52	..	41	48	100	111	117	107	128	112½
57	Grass Pea	16	40	22	..	32	20	36	..	24	40	26	20	114	121	127	120	141	124½

The twelve varieties of pease which have given the largest crops at the several experimental farms during 1901, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Cooper	33	20	7. Centennial	31	20
2. English Grey	32	..	8. Vincent	30	40
3. Paragon	32	..	9. Elder	30	40
4. Nelson	32	..	10. Chancellor	30	40
5. French Canner	31	40	11. Kent	30	40
6. Bruce	31	40	12. Arthur	30	..

An average crop of 31 bushels 23 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Arthur	50	..	7. Bright	46	..
2. Pearl	50	..	8. Chancellor	45	20
3. Gregory	48	40	9. Fergus	45	20
4. Victoria	48	..	10. Elliot	44	40
5. Pride	46	40	11. Agnes	44	40
6. Elder	46	40	12. Crown	44	..

An average crop of 46 bushels 40 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Bush. Per acre.	Lbs.		Per acre. Bush.	Lbs.
1. Paragon	43	..	7. Mummy	39	40
2. Gregory	42	30	8. King	38	50
3. Macoun	41	40	9. German White	38	40
4. Picton	41	20	10. Crown	38	40
5. Victoria	41	20	11. Elliot	38	10
6. New Potter	41	20	12. Prince	38	..

An average crop of 40 bushels 18 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Bush. Per acre.	Lbs.		Per acre. Bush.	Lbs.
1. Oddfellow	66	..	7. White Wonder	57	..
2. Pride	60	20	8. King	56	..
3. German White	60	..	9. Fenton	54	40
4. Paragon	59	40	10. Crown	54	20
5. Daniel O'Rourke	59	..	11. Agnes	53	40
6. Gregory	58	40	12. Golden Vine	53	20

An average crop of 57 bushels 43 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. English Grey	64	..	7. Mackay	58	50
2. Harrison's Glory	60	40	8. Arthur	57	50
3. Duke	60	..	9. New Potter	57	20
4. Early Britain	59	20	10. Elephant Blue	57	..
5. Pride	59	20	11. Agnes	56	50
6. Fergus	59	..	12. Perth	56	..

An average crop of 58 bushels 51 lbs. per acre.

The twelve varieties of pease which have given the largest crops in 1901, taking the average results obtained on all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Gregory	45	54	7. Agnes	42	52
2. Pride	45	36	8. Crown	42	44
3. Paragon	45	32	9. Early Britain	42	40
4. New Potter	43	40	10. King	42	34
5. Arthur	43	36	11. Picton	42	34
6. Nelson	43	10	12. Victoria	42	20

An average crop of 43 bushels 36 lbs. per acre.

The average crop of all the varieties of pease tested at each of the experimental farms in 1901 was as follows :—At Ottawa, 27 bushels per acre ; Nappan, 41 bushels ; Brandon, 33 bushels 53 lbs.; Indian Head, 50 bushels 4 lbs., and at Agassiz, 49 bushels 57 lbs. The average return given by the whole of the varieties at all the farms was 40 bushels 23 lbs. per acre.

TRIAL PLOTS OF INDIAN CORN.

The number of varieties of Indian corn which have been tested in 1901 is thirty-four. These were planted in rows three feet apart and the plants thinned out to six or eight inches apart in the rows. The dates of planting were as follows:—At Ottawa, May 28 ; Nappan, June 3 ; Brandon, May 29 ; Indian Head, May 22, and at Agassiz, May 20 and 21.

All the corn was cut green and put into the silo for the winter feeding of stock. The dates of cutting were :—At Ottawa, September 18 ; Nappan, September 27 ; Brandon, September 5 ; Indian Head, September 2, and at Agassiz, October 14. The yield per acre has been calculated in each case from the weight obtained from two rows, each 66 feet long.

UNIFORM TEST PLOTS OF INDIAN CORN.

Number.	Name of Variety.	Yield per Acre at the several Experimental Farms, Season of 1901.											
		Ottawa, Ont.		Nappan, N. S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B. C.		Average of all Farms.	
		Per acre. Tons.	Lbs.	Per acre. Tons.	Lbs.	Per acre. Tons.	Lbs.	Per acre. Tons.	Lbs.	Per acre. Tons.	Lbs.	Per acre. Tons.	Lbs.
1	Superior Fodder	24	840	13	620	19	940	23	860	15	1,570	19	558
2	Early Mastodon	24	400	20	150	17	1,112	26	1,724	20	700	21	1,617
3	Early Butler	23	1,300	16	1,220	17	1,376	21	900	15	1,460	19	51
4	Rural Thoro'bred White Flint	23	200	14	1,700	23	860	20	524	22	220	20	1,501
5	Extra Early Huron	22	1,760	14	1,370	19	1,600	19	544	15	800	18	815
6	Giant Prolific Ensilage	22	1,540	14	1,370	18	1,752	25	1,480	12	1,410	18	1,910
7	Cloud's Early Yellow	22	1,540	19	1,600	18	300	24	388	12	1,520	19	1,070
8	Selected Leaming	22	.....	17	100	18	1,752	23	200	17	540	19	1,318
9	Red Cob Ensilage	22	.....	14	1,700	19	1,600	22	180	16	1,770	19	250
10	Evergreen Sugar	21	1,120	13	1,500	18	1,092	23	1,784	11	1,430	17	1,785
11	Champion White Pearl	21	460	17	320	18	1,356	19	1,600	16	1,440	18	1,435
12	Country Gentleman	20	1,360	12	1,850	16	1,660	22	1,850	9	150	16	974
13	Sanford	19	1,820	14	270	20	920	16	500	13	1,060	16	1,714
14	Salzer's All Gold	19	1,380	14	50	23	464	24	180	17	210	19	1,257
15	Mammoth Cuban	19	940	17	650	19	280	24	388	17	320	19	512
16	Canada White Flint	18	1,840	13	400	16	1,660	22	220	11	1,860	16	1,196
17	Pride of the North	18	1,820	15	1,800	20	656	26	800	16	1,000	19	1,215
18	Compton's Early	18	1,620	14	50	17	980	19	1,996	19	1,820	18	93
19	White Cap Yellow Dent	18	1,300	13	400	18	1,224	20	920	20	1,250	18	619
20	King of the Earliest	18	80	14	50	18	564	16	200	16	1,660	16	1,311
21	Mamm. Eight rowed Flint	17	1,420	13	620	19	1,732	20	1,844	22	1,320	18	1,787
22	Black Mexican	16	1,660	13	1,720	18	168	17	640	7	520	14	1,342
23	Early Yellow Long Eared	16	1,220	16	1,000	21	1,956	17	452	13	1,280	17	382
24	Longfellow	15	360	15	250	19	1,204	21	1,560	15	1,900	17	1,055
25	North Dakota White	14	1,700	12	750	20	1,448	21	504	15	360	16	1,752
26	Angel of Midnight	14	1,480	14	1,370	15	1,152	22	1,408	10	1,890	15	1,460
27	Pearce's Prolific	14	1,260	12	750	20	1,184	23	1,520	10	20	16	547
28	North Dakota Yellow	14	1,040	13	950	17	1,904	17	1,738	9	1,800	14	1,488
29	Kendall's Early Giant	13	1,280	13	950	17	452	17	188	13	1,610	15	94
30	Early August	10	240	9	1,800	*	.....	19	558	5	1,120	11	179
31	Salzer's Earliest Ripe	9	700	10	900	11	1,364	12	1,080	5	1,440	9	1,897
32	Extra Early Szekely	9	260	8	1,600	11	704	13	1,324	..	**	10	1,472
33	Yellow Six-weeks	9	40	10	550	11	176	19	1,904	5	560	11	238
34	Mitchell's Early	8	1,600	9	370	14	512	12	1,244	5	450	10	35

*Seed not received at Brandon.
**Did not germinate well at Agassiz.

The six varieties of Indian corn which have given the heaviest crops at the several experimental farms during 1901, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Superior Fodder	24	840	4. Rural Thoro'bred White Flint	23	200
2. Early Mastodon	24	400	5. Extra Early Huron	22	1,760
3. Early Butler	23	1,300	6. Giant Prolific Ensilage	22	1,540

An average crop of 23 tons 1,007 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Mastodon	20	150	4. Pride of the North	17	650
2. Cloud's Early Yellow	19	1,600	5. Champion White Pearl	17	320
3. Mammoth Cuban	17	650	6. Selected Leaming	17	100

An average crop of 18 tons 245 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Rural Thoro'bred White Flint	23	860	4. North Dakota White	20	1,448
2 Salzer's All Gold	23	464	5. Pearce's Prolific	20	1,184
3. Early Yellow Long-eared	21	1,956	6. Sanford	20	920

An average crop of 21 tons 1,472 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Mastodon	26	1,724	4. Cloud's Early Yellow	24	888
2. Pride of the North	26	800	5. Mammoth Cuban	24	888
3. Giant Prolific Ensilage	25	1,480	6. Salzer's All Gold	24	180

An average crop of 25 tons 493 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Cob Ensilage	16	1,770	4. Cloud's Early Yellow	12	1,520
2. Early Yellow Long-eared	13	1,280	5. Giant Prolific Ensilage	12	1,410
3. Sanford	13	1,060	6. Canada White Flint	11	1,860

An average crop of 13 tons 1,150 lbs. per acre.

The six varieties of Indian corn which have given the heaviest crops in 1901, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Mastodon	21	1,617	4. Salzer's All Gold	19	1,257
2. Rural Thoro'bred White Flint	20	1,501	5. Pride of the North	19	1,215
3. Selected Leaming	19	1,318	6. Cloud's Early Yellow	19	1,070

An average crop of 20 tons 330 lbs. per acre.

The average weight cut green of all the varieties of Indian corn tested at each of the experimental farms in 1901 was as follows :—At Ottawa, 17 tons 1,811 lbs. per acre ; Nappan, 14 tons 199 lbs.; Brandon, 18 tons 488 lbs.; Indian Head, 20 tons 1,211 lbs.; and at Agassiz, 13 tons 1,953 lbs. The average return given by the whole of the varieties at all the farms was 16 tons 1,932 lbs. per acre.

TRIAL PLOTS OF TURNIPS.

Twenty-nine varieties of turnips were tested during 1901, sown on drills or on the flat 2½ feet apart. Two sowings were made at each farm, the second sowing about two weeks later than the first. The dates of sowing will be found in the accompanying table, the dates on which the roots were pulled were as follows :—At Ottawa, October 14 ; Nappan, October, 30 ; Brandon, October 10 ; Indian Head, October 11, and at Agassiz, November 11. The yield per acre in each case has been calculated from the weight of roots gathered from two rows, each 66 feet long.

UNIFORM TEST PLOTS OF TURNIPS.

Number.	Name of Variety.	Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Sown May 8.	Sown May 22.	Sown May 27.	Sown June 10.	Sown May 16.	Sown May 30.	Sown May 21.	Sown May 29.	Sown May 28.	Sown June 11.	First Sowing.	Second Sowing.
		Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.	Per acre, Tons. Lbs.
1	Carter's Elephant	41 1,820	29 80	42 150	23 200	24 312	9 1,800	22 352	14 1,436	42 1,305	42 480	34 1,188	23 1,399
2	Hartley's Bronze	41 1,490	29 80	44 1,100	28 925	30 1,512	15 1,680	30 1,116	21 1,560	40 520	35 950	37 1,148	26 239
3	Drummond Purple Top	40 520	28 760	29 1,400	26 1,625	19 280	6 1,200	21 360	15 1,680	43 1,120	38 230	30 1,536	23 299
4	Halewood's Bronze Top	39 1,530	28 430	33 1,650	26 800	22 616	13 1,720	31 436	15 1,896	35 1,128	38 1,055	32 1,072	24 1,180
5	Hall's Westbury	37 1,240	27 1,110	31 1,525	25 1,150	31 1,624	16 1,792	32 548	24 840	45 420	42 1,470	35 1,471	27 872
6	Sutton's Champion	37 1,240	28 1,090	28 1,750	21 75	26 272	13 400	34 1,696	27 1,308	43 295	40 850	34 251	26 345
7	Bangholm Selected	36 1,590	25 1,480	35 950	24 1,500	23 1,784	13 1,984	22 1,804	27 1,532	38 1,220	42 1,140	31 1,069	26 1,927
8	Emperor Swede	36 270	32 1,670	31 700	29 1,400	15 1,944	12 1,080	28 1,948	22 1,540	49 10	48 30	32 574	29 344
9	Champion Purple Top	34 1,300	27 450	28 1,750	18 1,125	14 1,568	13 1,984	25 1,744	20 1,848	40 350	39 530	28 1,742	23 1,987
10	Prize Purple Top	34 310	23 1,520	34 475	28 1,750	26 1,064	14 1,040	30 192	36 72	46 70	38 1,385	34 422	28 753
11	Magnum Bonum	33 1,650	24 1,830	28 1,750	19 1,600	26 8	12 1,872	33	28 1,156	48 1,020	38 1,220	34 86	24 1,955
12	Marquis of Lorne	33 1,320	27 120	33 1,650	25 1,975	19 1,864	11 176	23 992	23 1,124	44 440	34 1,630	31 53	24 1,005
13	New Arctic	33 990	21 240	41 500	32 350	26 536	11 1,760	20 1,976	25 1,480	43 1,935	41 1,820	33 387	26 1,130
14	Selected Purple Top	33 330	28 1,750	34 475	24 1,500	17 1,640	11 176	37 1,900	26 140	39 1,530	35 290	32 1,175	25 371
15	Skirvings	32 1,340	27 1,110	30 225	22 1,375	23 464	14 1,040	28 1,288	27 120	43 1,450	40 1,180	31 1,353	26 965
16	West Norfolk Red Top	32 1,340	26 800	30 1,875	29 1,400	20 920	11 1,760	28 496	20 1,976	37 1,570	29 1,730	30 40	23 1,533
17	Imperial Swede	32 1,340	22 880	40 850	25 325	25 1,744	14 776	28 232	26 536	47 380	42 1,140	34 1,709	26 331
18	Selected Champion	32 1,010	25 1,150	36 1,425	30 225	17 1,640	12 1,872	33	25 952	41 800	35 620	32 575	25 1,764
19	Shamrock Purple Top	32 20	26 1,790	33 1,650	28 1,750	23 200	15 1,944	34 1,300	29 1,796	38 890	37 1,900	32 812	27 1,836
20	Elephant's Master	31 1,690	20 1,580	30 1,875	20 1,250	24 1,368	10 328	29 344	24 1,500	44 770	35 600	32 409	22 651
21	Giant King	31 1,360	26 1,460	35 950	22 550	21 1,296	7 1,312	25 160	16 1,132	40 1,180	35 620	30 1,789	21 1,415
22	Prize Winner	30 1,380	26 140	28 700	20 1,250	30 720	17 320	33 1,452	26 932	43 460	42 1,140	33 543	26 1,156
23	East Lothian	30 720	27 1,440	31 700	22 1,375	24 576	12 552	24 972	20 1,316	46 1,720	39 540	31 938	24 1,045
24	Perfection Swede	30 60	29 1,070	37 1,900	30 1,875	24 312	16 1,264	39 144	32 944	38 1,055	38 230	33 1,894	29 1,077
25	Kangaroo	27 120	22 1,870	33 1,650	24 1,500	25 424	9 1,536	28 760	24 1,632	40 1,860	45 1,080	31 163	25 1,123
26	Monarch	25 490	22 880	33 1,650	24 675	21 1,560	13 400	41 104	28 364	45 172	42 1,140	33 795	26 292
27	Mammoth Clyde	24 180	22 550	37 1,075	34 1,500	27 1,704	15 360	25 688	24 576	41 1,820	39 540	31 693	27 305
28	Jumbo	23 1,850	20 590	37 250	36 800	22 1,408	8 1,160	23 1,256	19 280	45 255	38 1,220	30 1,004	24 1,210
29	Webb's New Renown	16 670	17 1,970	33	26 1,625	*	*	35 1,808	30 1,908	34 1,960	38 65	30 109	28 892

*This variety at Brandon was destroyed by rot.

The crops of the two sowings of turnips at the experimental farms in 1901 have averaged per acre as follows :—

	Tons.	Lbs.
Central Experimental Farm, first sowing	32	1,420
" " second sowing	25	1,582
Experimental Farm, Nappan, first sowing	34	297
" " second sowing	26	188
" Brandon, first sowing	23	1,049
" " second sowing	12	1,617
" Indian Head, first sowing	29	899
" " second sowing	24	951
" Agassiz, first sowing	42	886
" " second sowing	39	442

Average crop from all the plots at all the farms, first sowing, 32 tons 910 lbs.; second sowing, 25 tons 1,356 lbs., showing an advantage in favour of the first sowing of 6 tons 1,554 lbs. per acre. It will be seen that the early sown plots have given the larger crops at all the experimental farms.

The six varieties of turnips which have given the heaviest crop at the several experimental farms during the season of 1901 are the following. (Where not otherwise stated the quantities given are all from the early sown plots) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Carter's Elephant	41	1,820	4. Halewood's Bronze Top	39	1,530
2. Hartley's Bronze	41	1,490	5. Hall's Westbury	37	1,240
3. Drummond Purple Top	40	520	6. Sutton's Champion	37	1,240

An average crop of 39 tons 1,640 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Hartley's Bronze	44	1,100	4. Imperial Swede	40	850
2. Carter's Elephant	42	150	5. Perfection Swede	37	1,900
3. New Arctic	41	500	6. Mammoth Clyde	37	1,075

An average crop of 40 tons 1,262 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Hall's Westbury	31	1,624	4. Mammoth Clyde	27	1,704
2. Hartley's Bronze	30	1,512	5. Prize Purple Top	26	1,064
3. Prize Winner	30	720	6. New Arctic	26	536

An average crop of 28 tons 1,860 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Monarch	41	104	4. Prize Purple Top (second sowing)	36	72
2. Perfection Swede	39	144	5. Webb's New Renown	35	1,808
3. Selected Purple Top	37	1,900	6. Sutton's Champion	34	1,696

An average crop of 37 tons 954 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Emperor Swede	49	10	4. East Lothian	46	1,720
2. Magnum Bonum	48	1,020	5. Prize Purple Top	46	70
3. Imperial Swede	47	380	6. Kangaroo (second sowing)	45	1,080

An average crop of 47 tons 380 lbs. per acre.

The six varieties of turnips which have produced the heaviest crops in 1901, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Hartley's Bronze	37	1,148	4. Carter's Elephant	34	1,188
2. Hall's Westbury	35	1,471	5. Prize Purple Top	34	422
3. Imperial Swede	34	1,709	6. Sutton's Champion	34	251

An average crop of 35 tons 365 lbs. per acre.

TRIAL PLOTS OF MANGELS.

Twenty-five varieties of mangels have been under test during 1901, all sown on drills or on the flat in rows 2½ feet apart. Two sowings were made at each farm, the second sowing about two weeks later than the first. The dates of sowing will be found in the accompanying table ; the dates on which the roots were pulled were as follows :—At Ottawa, October 14 ; Nappan, October 17 ; Brandon, September 24 ; Indian Head, October 1, and at Agassiz, November 6. The yield per acre has been calculated in each case from the weight of roots gathered from two rows, each 66 feet long.

UNIFORM TEST PLOTS OF MANGELS.

Number.	Name of Variety.	Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N. W. T.		Agassiz, B.C.		Average of all Farms.	
		Sown May 8.	Sown May 22.	Sown May 27.	Sown June 10.	Sown May 16.	Sown May 30.	Sown May 22.	Sown May 29.	Sown April 26.	Sown May 10.	First Sowing.	Second Sowing.
		Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.
1	Champion Yellow Globe...	45 1,080	28 430	32 1,340	31 1,525	18 1,488	15 360	23 1,520	22 1,804	20 95	19 280	28 305	23 880
2	Mam. Yellow Intermediate.	44 1,100	28 1,750	33	37 250	25 160	13 400	26 1,328	22 880	24 840	21 570	30 1,486	24 1,170
3	Yellow Intermediate.....	44 110	32 350	30 1,875	31 700	34 1,168	13 1,720	23 728	25 1,612	21 1,065	19 610	30 1,789	24 998
4	Giant Yellow Intermediate	43 790	30 1,380	27 1,440	31 1,525	34 640	13 928	25 952	22 1,936	26 120	23 530	31 788	24 859
5	Prize Winner Yellow Globe	42 1,800	34 1,630	27 1,275	27 1,275	15 1,680	32 1,208	27 1,208	29 80	20 460	14 1,865	26 1,685	27 1,612
6	Norbiton Giant.....	42 1,470	27 450	32 350	32 1,175	35 488	20 128	24 972	21 504	19 1,600	17 1,640	30 1,776	23 1,579
7	Half Long Sugar Rosy....	42 480	27 450	35 1,775	30 225	32 680	24 1,368	27 780	24 180	15 360	14 1,700	30 1,215	22 385
8	Giant Yellow Half Long...	42 480	34 1,300	29 400	30 1,875	21 240	18 960	26 308	24 576	16 1,085	17 1,475	27 103	25 437
9	Gate Post.....	41 830	35 290	39 1,200	32 1,175	29 1,136	28 1,552	24 972	17 1,940	16 1,165	17 1,640	30 661	26 919
10	Giant Yellow Globe.....	41 335	31 370	35 620	33 ...	36 1,920	32 1,472	25 28	26 992	19 280	16 670	31 1,037	27 1,901
11	Half Long Sugar White...	39 1,695	30 1,380	35 125	31 700	46 400	38 560	24 1,368	27 384	17 1,640	15 360	32 1,446	28 1,077
12	Mammoth Long Red.....	37 1,570	27 780	28 1,750	28 925	37 1,768	29 80	21 1,824	19 1,336	16 1,660	16 1,990	28 1,314	24 622
13	Warden Orange Globe.....	37 910	28 760	34 1,795	31 205	28 232	17 1,904	19 16	24 708	20 920	19 940	27 1,975	24 503
14	Golden Fleshed Tankard..	36 1,590	24 675	28 1,750	36 1,755	18 432	25 1,480	19 940	22 1,012	13 730	17 980	23 688	25 780
15	Leviathan Long Red.....	36 1,260	30 1,380	29 400	30 1,875	26 800	21 240	23 1,124	17 1,640	16 835	15 690	26 884	23 365
16	Prize Mamm. Long Red...	36 270	32 20	29 1,895	29 575	31 1,360	24 576	30 1,380	29 740	17 320	16 1,000	29 245	26 582
17	Lion Yellow Intermediate..	38 1,280	31 1,360	29 1,895	33 825	24 1,104	20 920	27 912	27 1,572	22 1,000	20 95	28 1,238	26 1,354
18	Gate Post Yellow.....	34 1,960	30 60	29 400	31 1,205	24 1,896	33 1,848	20 1,448	18 960	15 1,020	13 400	25 145	25 895
19	Mammoth Oval Shaped....	34 640	26 1,460	31 1,525	31 1,195	28 760	19 1,600	23 332	28 1,552	19 775	21 590	27 806	25 1,279
20	Selected Mamm. Long Red	34 640	28 1,420	28 760	28 100	37 1,240	26 272	26 1,856	28 1,816	19 1,435	21 240	29 786	26 1,170
21	Ward's Large Oval Shaped.	34 310	22 1,540	31 700	25 125	27 384	22 88	29 740	21 1,560	9 480	11 1,430	26 523	20 1,549
22	Red Fleshed Tankard.....	33 1,320	26 510	33 1,650	25 1,975	12 24	11 440	10 1,648	8 236	*	*	22 1,161	17 1,790
23	Triumph Yellow Globe...	33 990	25 490	25 325	31 1,525	29 1,400	26 8	25 1,292	24 444	16 340	17 320	26 69	24 1,757
24	Canadian Giant.....	30 225	30 60	34 1,300	31 700	21 504	34 640	28 1,948	18 168	12 1,740	16 1,330	25 1,143	26 180
25	Yellow Fleshed Tankard..	29 1,070	24 1,830	37 1,075	28 100	19 1,600	19 1,864	22 1,672	19 1,864	19 1,930	17 320	25 1,869	21 1,996

The crops from the two sowings of mangels at the experimental farms in 1901 have averaged per acre as follows:—

	Tons.	Lbs.
Central Experimental Farm first sowing.....	38	648
" " " second sowing.....	29	405
Experimental Farm Nappan first sowing.....	31	1,425
" " " second sowing.....	30	1,900
" " Brandon first sowing.....	27	1,320
" " " second sowing	23	665
Experimental Farm Indian Head, first sowing.....	24	772
" " " second sowing.....	22	1,940
" " Agassiz, first sowing.....	18	412
" " " second sowing.....	17	1,153

* Failed entirely.

Average crop from all the plots, at all the farms: first sowing 28 tons 215 lbs.; second sowing 24 tons 1613 lbs. showing an advantage in favour of early sowing of 3 tons 602 lbs. per acre.

The early sown mangels have given larger crops at all of the experimental farms.

The six varieties of mangels which have produced the heaviest crops at the several experimental farms during 1901 are the following. (Unless otherwise stated, the yields given are all from the earliest sown plots) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Champion Yellow Globe..	45	1,080	4. Giant Yellow Intermediate... ..	43	790
2. Mammoth Yellow Intermediate...	44	1,110	5. Prize Winner Yellow Globe... ..	42	1,800
3. Yellow Intermediate..	44	110	6. Norbiton Giant....	42	1,470

An average crop of 43 tons 1,727 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Gate Post..	39	1,200	4. Yellow Fleshed Tankard...	36	1,755
2. Golden Fleshed Tankard....	37	1,075	5. Half Long Sugar Rosy..	35	1,775
3. Mamm. Yellow Intermediate (2nd sowing)..	37	250	6. Giant Yellow Globe..	35	620

An average crop of 37 tons 112 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Half Long Sugar White..	46	400	4. Giant Yellow Globe..	36	1,920
2. Mammoth Long Red...	37	1,768	5. Norbiton Giant..	35	488
3. Selected Mammoth Long Red.. ..	37	1,240	6. Yellow Intermediate....	34	1,168

An average crop of 38 tons 164 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Prize Mammoth Long Red..	30	1,380	4. Canadian Giant....	28	1,948
2. Ward's Long Oval-shaped..	29	740	5. Selected Mammoth Long Red (2nd sowing)..	28	1,816
3. Prize Winner Yellow Globe (2nd sowing)..	29	80	6. Mammoth Oval-shaped..	28	1,552

An average crop of 29 tons 586 lbs per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant Yellow Intermediate	26	120	4. Yellow Intermediate....	21	1,065
2. Mammoth Yellow Intermediate....24		840	5. Mammoth Oval-shaped (2nd sowing)..	21	590
3. Lion Yellow Intermediate..	22	1,000	6. Selected Mammoth Long Red...	21	240

An average crop of 22 tons 1,642 lbs. per acre.

The six varieties of mangels which have produced the heaviest crops in 1901, taking the average of the results obtained on all the experimental farms, are :

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Half Long Sugar White..	32	1,446	4. Yellow Intermediate....	30	1,789
2. Giant Yellow Globe.	31	1,037	5. Norbiton Giant....	30	1,776
3. Giant Yellow Intermediate.... ..	31	783	6. Mammoth Yellow Intermediate..	30	1,486

An average crop of 31 tons 720 lbs. per acre.

TRIAL PLOTS OF CARROTS.

Twenty different sorts of carrots were tested during 1901, all sown on drills or on the flat in rows two feet apart. Two sowings were made in each case, the second sowing two weeks later than the first. The dates of sowing will be found in the accompanying table ; the dates on which the carrots were pulled were as follows :—At Ottawa, October 14 ; Nappan, October 30 ; Brandon, October 12 ; Indian Head, October 12, and at Agassiz, November 5. The yield per acre in each case has been calculated from the weight of roots gathered from two rows, each 66 feet long.

UNIFORM TEST PLOTS OF CARROTS.

Number.	Name of Variety.	Ottawa, Ont.		Nappan, N. S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Sown May 8.	Sown May 22.	Sown May 27.	Sown June 10.	Sown May 16.	Sown May 30.	Sown May 21.	Sown May 29.	Sown April 25.	Sown May 9.	First Sowing.	Second Sowing.
		Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.
1	Half Long White	43 790	27 1,440	21 1,725	20 425	20 480	15 800	12 1,344	6 1,860	25 490	28 1,585	26 523	20 1,549
2	New White Intermediate	42 1,140	31 1,030	28 100	21 900	19 1,600	12 640	12 1,608	11 1,760	25 1,263	26 140	25 1,542	20 1,294
3	Mamm. White Intermediate	40 1,510	36 1,260	29 1,400	17 1,475	11 880	17 1,200	12 420	6 1,728	27 1,110	25 1,974	24 665	20 1,927
4	Giant White Vosges	38 890	30 1,050	31 700	21 900	21 240	12 1,080	8 1,744	8 1,952	28 1,585	28 740	25 1,432	20 744
5	Iverson's Champion	37 580	29 1,400	21 1,725	20 1,250	14 1,920	14 600	12 1,212	10 592	30 720	30 390	23 831	21 46
6	Half Long Chantenay	37 250	23 1,190	23 1,025	19 1,600	6 320	13 1,720	12 816	8 1,688	20 920	20 1,580	19 1,866	17 756
7	Ontario Champion	34 1,300	34 310	30 1,050	21 1,725	20 480	13 840	12 1,740	11 572	28 100	26 1,130	25 534	21 915
8	Improved Short White	33 660	32 20	27 450	19 775	15 1,680	14 1,040	11 1,232	12 1,080	30 1,220	25 637	23 1,448	20 1,510
9	Green Top White Orthe	30 1,050	22 1,870	26 1,295	21 900	6 760	16 1,880	11 1,668	8 896	27 1,440	28 1,585	20 1,243	19 1,426
10	Long Yellow Stump rooted	28 1,750	23 860	24 675	19 775	14 1,920	12 1,520	11 968	10 1,780	23 1,520	25 1,314	20 1,367	18 850
11	White Vosges Large Short	24 1,500	22 1,870	17 1,475	14 1,700	*	14 1,480	12 552	10 1,252	21 1,230	24 1,500	18 533	17 1,160
12	Yellow Intermediate	24 1,500	17 980	24 1,500	20 1,250	17 1,640	11 880	9 1,932	8 1,424	26 1,046	21 240	20 1,524	15 175
13	Carter's Orange Giant	24 840	21 240	19 775	18 525	7 140	14 1,920	9 1,008	6 1,728	26 1,130	26 635	17 779	17 1,010
14	Early Gem	23 530	21 240	24 1,005	16 1,825	4 1,240	13 840	7 1,312	7 652	26 800	21 1,548	17 577	16 221
15	Guerande or Ox-Heart	22 550	21 570	26 800	17 650	5 1,880	16 1,000	9 1,932	6 1,200	17 1,640	18 1,143	16 960	16 113
16	Scarlet Intermediate	21 1,560	20 590	19 775	16 1,825	16 1,000	8 720	9 1,400	9 216	23 1,468	21 240	18 441	11 318
17	White Belgian	19 610	23 530	29 1,400	19 1,600	19 1,600	13 1,720	12 816	11 1,668	19 1,765	24 1,181	20 438	18 1,340
18	Long Orange or Surrey	17 1,970	14 1,370	17 1,745	16 175	9 40	8 720	5 1,616	4 1,504	14 1,040	13 1,720	13 82	11 1,098
19	Long Scarlet Altringham	16 1,330	14 50	20 425	18 525	8 1,600	7 80	7 784	5 448	20 590	19 1,930	14 1,346	12 1,807
20	Scarlet Nantes	14 710	13 730	18 300	11 1,925	10 1,560	7 960	7 388	6 1,464	13 1,573	13 70	12 1,706	10 1,030

* The seed of this variety was not received early enough for the first sowing.

The crops from the two sowings of carrots at the experimental farms in 1901 have averaged as follows:—

Central Experimental Farm, first sowing	28 tons.	1,651 lbs.
" " second sowing	24 "	180 "
Experimental Farm, Nappan, first sowing	24 "	217 "
" " second sowing	18 "	1,436 "
" Brandon, first sowing	13 "	420 "
" " second sowing	12 "	1,982 "
Experimental Farm, Indian Head, first sowing	10 tons.	1,124 lbs.
" " second sowing	8 "	1,473 "
" " Agassiz, first sowing	23 "	1,932 "
" " " second sowing	23 "	1,164 "

Average crop from all the plots at all the farms, first sowing, 20 tons 269 lbs., second sowing, 17 tons 1,247 lbs., showing an advantage in favour of the early sown plots of 2 tons 1,022 lbs. per acre.

The six varieties of carrots which have produced the heaviest crops during the season of 1901 are the following. (Unless otherwise stated, the yields given are all from the earliest sown plots) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Half Long White	43	790	4. Giant White Vosges	38	890
2. New White Intermediate	42	1,140	5. Iverson's Champion	37	580
3. Mammoth White Intermediate	40	1,510	6. Half Long Chantenay	37	250

An average crop of 39 tons 1,860 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant White Vosges	31	700	4. White Belgian	29	1,400
2. Ontario Champion	30	1,050	5. New White Intermediate	28	100
3. Mammoth White Intermediate	29	1,400	6. Improved Short White	27	450

An average crop of 29 tons 850 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant White Vosges	21	240	4. White Belgian	19	1,600
2. Half Long White	20	480	5. New White Intermediate	19	1,600
3. Ontario Champion	20	480	6. Yellow Intermediate	17	1,640

An average crop of 19 tons 1,673 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Ontario Champion	12	1,740	4. Improved Short White (2nd sowing)	12	1,080
2. New White Intermediate	12	1,608	5. Half Long Chantenay	12	816
3. Iverson's Champion	12	1,212	6. White Belgian	12	816

An average crop of 12 tons 1,212 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Improved Short White	30	1,220	4. Green Top White Orthe (2nd sowing)	28	1,585
2. Iverson's Champion	30	720	5. Half Long White (2nd sowing)	28	1,585
3. Giant White Vosges	28	1,585	6. Mammoth White Intermediate	27	1,110

An average crop of 29 tons 301 lbs. per acre.

The six varieties of carrots which have produced the heaviest crops in 1901, taking the average of the results obtained at the several experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Half Long White...	26	523	4. Ontario Champion....	25	534
2. New White Intermediate...	25	1,542	5. Mammoth White Intermediate...	24	665
3. Giant White Vosges...	25	1,432	6. Improved Short White..	23	1,448

An average crop of 25 tons 357 lbs. per acre.

TRIAL PLOTS OF SUGAR BEETS.

Seven varieties of sugar beets have been tested during 1901, sown on drills or on the flat two feet apart. Two sowings were made at each farm, the second sowing about two weeks later than the first. The dates of sowing will be found in the accompanying table ; the dates on which the roots were pulled were as follows :—At Ottawa, October 14 ; Nappan, October 17 ; Brandon, September 24 ; Indian Head, October 1, and at Agassiz, November 6. The yield per acre in each instance has been calculated from the weight of roots gathered from two rows, each 66 feet long.

UNIFORM TEST PLOTS OF SUGAR BEETS.

Number.	Name of Variety.	Ottawa, Ont.		Nappan, N. S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Sown May 8.	Sown May 22.	Sown May 27.	Sown June 10.	Sown May 16.	Sown May 30.	Sown May 22.	Sown May 29.	Sown April 26.	Sown May 10.	First Sowing.	Second Sowing.
		Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre Tons. Lbs.	Per acre. Tons. Lbs.
1	Red Top Sugar	34 640	25 1,150	27 780	30 225	30 984	29 1,136	27 912	25 1,348	13 400	15 30	26 1,143	25 378
2	Royal Giant	33 660	29 1,070	25 1,645	26 1,625	18 960	18 696	29 1,664	26 8	16 1,165	17 816	24 1,619	23 1,243
3	Danish Improved	33 330	25 490	25 1,975	26 1,625	27 1,704	28 496	18 1,784	23 860	11 440	12 1,420	23 847	23 578
4	Danish Red Top	31 1,360	25 1,480	25 325	28 1,750	29 344	28 232	24 1,896	25 1,744	16 1,330	17 980	25 1,051	25 437
5	Improved Imperial	28 430	26 1,130	33 —	28 1,750	18 960	26 1,856	27 1,440	20 1,844	16 1,990	13 1,720	24 1,764	23 860
6	Wanzleben	25 160	21 1,890	25 655	21 900	25 160	22 1,672	16 1,396	19 1,600	9 480	9 150	20 570	19 42
7	Vilmorin's Improved	22 1,210	18 300	22 1,045	20 1,250	20 1,184	18 1,752	16 624	16 472	13 1,060	14 1,700	19 225	17 1,495

The crops from the two sowings of sugar beets at the experimental farms, in 1901, have averaged as follows :—

	Tons.	Lbs.
Central Experimental Farm, first sowing	29	1,541
" " " second sowing	24	1,359
Experimental Farm, Nappan, first sowing	26	918
" " " second sowing	26	446
" " Brandon, first sowing	24	614
" " " second sowing	24	1,406
" " Indian Head, first sowing	23	245
" " " second sowing	22	1,125
" " Agassiz, first sowing	13	1,838
" " " second sowing	14	688

Average crop from all the plots at all the farms: first sowing, 23 tons 1,031 lbs.; second sowing, 22 tons 1,005 lbs., showing an advantage in favour of early sowing of 1 ton 26 lbs. per acre.

The four varieties of sugar beets which have produced the heaviest crops during the season of 1901 are the following. (Unless otherwise stated, the yields given are all from the earlier sown plots) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Top Sugar..	34	640	3. Danish Improved..	33	330
2. Royal Giant...	33	660	4. Danish Red Top...	31	1,360

An average crop of 33 tons 497 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Improved Imperial..	33	..	3. Danish Red Top (2nd sowing)...	28	1,750
2. Red Top Sugar (2nd sowing)... ..	30	225	4. Danish Improved (2nd sowing)..	26	1,625

An average crop of 29 tons 1,400 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Top Sugar..	30	984	3. Danish Improved (2nd sowing)..	28	496
2. Danish Red Top....	29	344	4. Improved Imperial (2nd sowing)	26	1,856

An average crop of 28 tons 1,420 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Royal Giant...	29	1,664	3. Red Top Sugar....	27	912
2. Improved Imperial....	27	1,440	4. Danish Red Top (2nd sowing)....	25	1,744

An average crop of 27 tons 1,440 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top (2nd sowing)....	17	980	3. Improved Imperial...	16	1,990
2. Royal Giant (2nd sowing)...	17	816	4. Red Top Sugar....	15	30

An average crop of 16 tons 1,454 lbs. per acre.

The four varieties of sugar beets which have produced the heaviest crops in 1901, taking the average of the results obtained at the several experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Top Sugar...	26	1,113	3. Improved Imperial...	24	1,764
2. Danish Red Top....	25	1,051	4. Royal Giant..	24	1,619

An average crop of 25 tons 794 lbs. per acre.

TRIAL PLOTS OF POTATOES.

Eighty-seven varieties of potatoes have been under test in the uniform trial plots during 1901. The potatoes to be planted were cut into pieces, with two or three eyes in each, and these were planted in rows 2½ feet apart, the sets being placed a foot apart in the rows. The following were the dates of planting and digging :—At Ottawa, planted May 28, dug September 5 ; Nappan, planted May 17, dug September 23 ; Brandon, planted May 18, dug October 5 ; Indian Head, planted May 20, dug October 3, and at Agassiz, planted May 8 and 9 and dug October 22 :—

UNIFORM TEST PLOTS OF POTATOES.

Number.	Name of Variety.	Yield at the Several Experimental Farms, Season of 1901.											
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Per acre.		Per acre.		Per acre.		Per acre.		Per acre.		Per acre.	
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
1	Dreer's Standard	506	..	345	24	509	40	576	..	*		484	16
2	Late Puritan	503	48	385	..	476	40	556	48	556	36	495	34
3	Early White Prize	501	36	259	36	458	20	390	24	429	54	407	58
4	I. X. L	492	48	266	12	623	20	526	56	553	18	492	31
5	Uncle Sam	484	..	270	36	487	40	567	28	686	24	499	14
6	Burnaby Seedling	479	36	272	48	561	..	584	32	607	12	501	2
7	Canadian Beauty	479	36	404	48	473	..	520	40	470	48	469	46
8	Sabean's Elephant	473	..	402	36	619	40	480	..	569	48	509	1
9	Green Mountain	470	48	266	12	414	20	657	4	553	18	472	20
10	Seattle	462	..	345	24	337	20	520	32	541	12	441	18
11	Vick's Extra Early	462	..	336	36	388	40	292	16	633	36	422	38
12	Money Maker	459	48	292	36	520	40	497	4	673	12	488	40
13	American Wonder	455	24	209	..	586	40	599	28	523	36	474	50
14	Holborn Abundance	453	12	360	48	414	20	531	12	651	12	482	9
15	Burpee's Extra Early	446	36	211	12	377	40	292	16	398	12	345	11
16	Clay Rose	444	24	352	..	469	20	548	16	613	48	485	34
17	Maggie Murphy	440	..	286	..	484	..	644	16	440	..	458	51
18	Early Puritan	435	36	248	36	480	20	177	4	592	54	386	54
19	Troy Seedling	435	36	374	..	381	20	482	8	554	24	445	30
20	Rural Blush	433	24	345	48	473	..	615	..	444	24	462	19
21	Rochester Rose	422	24	264	..	352	..	390	24	622	36	410	17
22	McIntyre	420	12	316	48	377	40	392	32	660	..	433	26
23	Cambridge Russet	420	12	352	..	473	..	546	8	525	48	463	26
24	Polaris	418	..	187	..	344	40	433	4	677	36	412	4
25	Early St. George	418	..	308	36	421	40	428	48	448	58	405	12
26	Carman No. 1	415	48	250	48	539	..	663	28	541	12	482	3
27	State of Maine	413	36	222	12	597	40	578	8	519	12	466	10
28	Great Divide	411	24	312	24	462	..	548	16	371	48	421	10
29	Early Norther	409	12	272	48	498	40	375	28	475	12	406	16
30	Rawdon Rose	407	..	336	36	418	..	309	20	484	..	390	59
31	Earliest of All	407	..	187	..	308	..	371	12	396	..	333	50
32	Vanier	402	36	327	48	509	40	369	4	675	24	456	54
33	Enormous	402	36	352	..	542	40	373	20	506	..	435	19
34	Quaker City	400	24	303	36	513	20	567	28	574	12	471	48
35	Brown's Rot Proof	398	12	356	24	575	40	396	48	533	30	452	7
36	Early Harvest	398	12	257	24	539	..	437	20	528	..	431	59
37	Irish Cobbler	396	..	290	24	476	40	486	24	314	36	392	49
38	Early Sunrise	391	36	213	24	326	30	505	36	391	36	365	44
39	Delaware	389	24	279	24	425	20	603	44	543	24	448	15
40	Wonder of the World	389	24	†		517	.	268	48	501	36	419	12
41	Everett	385	..	294	48	462	..	381	36	475	12	399	43
42	General Gordon	382	48	275	..	476	40	612	16	537	54	456	56
43	Reeves' Rose	376	12	204	36	575	40	405	20	608	18	434	1
44	Country Gentleman	374	..	292	36	491	20	610	8	509	18	455	29

* Not planted at Agassiz. † Not planted at Nappan.

UNIFORM TEST PLOTS OF POTATOES—*Concluded.*

Number.	Name of Variety.	Yield at the Several Experimental Farms, Season of 1901.											
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.
45	Lee's Favourite.....	369	36	220	..	414	20	396	48	614	54	403	8
46	New Queen.....	369	36	264	..	469	20	458	40	521	24	416	36
47	American Giant.....	367	24	272	48	502	20	599	52	662	12	480	55
48	Early Michigan.....	367	24	171	36	410	40	480	..	500	30	386	2
49	Sir Walter Raleigh..	365	12	310	12	396	..	398	56	312	24	356	33
50	Flemish Beauty.....	365	12	288	12	388	40	499	12	606	6	429	28
51	Seedling No. 7.....	365	12	356	24	506	..	505	36	618	12	470	17
52	Seedling No. 230.....	360	48	308	12	465	40	569	36	624	48	465	49
53	Rural No. 2.....	354	12	360	48	352	..	315	44	352	..	346	57
54	Northern Spy.....	354	12	286	..	506	..	616	32	616	..	475	45
55	Sharpe's Seedling....	345	24	224	24	311	40	486	24	533	30	380	16
56	Dakota Red.....	343	12	290	24	425	20	595	12	682	..	467	14
57	Swiss Snow Flake....	338	48	352	..	480	20	548	16	673	12	478	31
58	Early Rose.....	336	36	187	..	440	..	243	12	437	38	328	53
59	Early Ohio.....	336	36	176	..	333	40	362	40	338	48	309	33
60	Pearce's Extra Early.	336	36	297	..	495	..	379	44	347	36	371	11
61	Early Market.....	336	36	193	36	399	40	298	40	316	48	309	4
62	Irish Daisy.....	336	36	418	..	414	20	582	24	580	48	466	26
63	Early Andes.....	334	24	255	12	209	..	260	16	475	12	306	49
64	Bovee.....	334	24	191	24	462	..	416	..	629	12	406	36
65	Thorburn.....	327	48	277	12	403	20	392	32	435	36	367	18
66	Prize Taker.....	325	36	290	24	374	..	477	52	613	48	416	20
67	Rose No. 9.....	321	12	418	..	531	40	571	44	545	36	477	38
68	White Beauty.....	319	..	316	48	553	40	443	44	413	36	409	22
69	Chicago Market.....	316	48	211	12	421	40	573	52	479	46	400	40
70	Daisy.....	314	36	200	12	597	40	334	56	558	48	401	14
71	Pearce's Prize Winner	314	36	323	24	432	40	492	48	400	34	392	48
72	Carman No. 3.....	312	24	341	..	418	..	629	20	585	12	457	11
73	Empire State.....	308	..	233	12	484	..	524	48	594	..	428	48
74	Ohio Junior.....	308	..	275	..	311	40	300	48	365	12	312	8
75	Penn Manor.....	305	48	341	..	462	..	531	12	352	..	398	24
76	Early Six Weeks.....	303	36	220	..	392	20	392	32	343	12	330	20
77	Beauty of Hebron....	294	48	330	..	425	20	430	56	514	48	399	10
78	Maule's Thoro'bred..	290	24	268	24	513	20	311	28	479	46	372	40
79	Hale's Champion.....	290	24	336	36	737	..	477	52	613	48	491	8
80	Reading Giant.....	286	..	209	..	403	20	475	44	*		343	31
81	Lizzie's Pride.....	275	..	259	36	517	..	541	52	510	24	420	46
82	New Variety No. 1...	270	36	253	..	414	20	590	56	629	12	431	37
83	Prolific Rose.....	264	..	319	..	590	20	366	56	385	32	385	10
84	Bill Nye.....	253	..	341	..	520	40	526	56	431	..	414	31
85	Clarke's No. 1.....	242	..	187	..	498	40	†		364	6	322	56
86	Brownell's Winner...	231	..	332	12	546	20	433	4	547	48	418	5
87	Houlton Rose.....	228	48	332	12	465	40	428	48	542	18	399	33
88	Up to Date.....	226	36	211	12	212	40	†		426	48	269	19
89	Pride of the Market.	173	48	341	..	421	40	458	40	430	39	365	9

* Not planted at Agassiz. †Not planted at Indian Head.

The twelve varieties of potatoes which have produced the largest crops at the several experimental farms during the season of 1901 are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Dreer's Standard	506	..	7. Canadian Beauty	479	36
2. Late Puritan	503	48	8. Sabean's Elephant	473	..
3. Early White Prize	501	36	9. Green Mountain	470	48
4. I. X. L.	492	48	10. Seattle	462	..
5. Uncle Sam	484	..	11. Vick's Extra Early	462	..
6. Burnaby Seedling	479	36	12. Money Maker	459	48

An average crop of 481 bushels 15 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Rose, No. 9	418	..	7. Holborn Abundance	360	48
2. Irish Daisy	418	..	8. Rural, No. 2	360	48
3. Canadian Beauty	404	48	9. Seedling, No. 7	356	24
4. Sabean's Elephant	402	36	10. Brown's Rot Proof	356	24
5. Late Puritan	385	..	11. Clay Rose	352	..
6. Troy Seedling	374	..	12. Cambridge Russet	352	..

An average crop of 378 bushels 24 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Hale's Champion	737	..	7. American Wonder	586	40
2. I. X. L.	623	20	8. Brown's Rot Proof	575	40
3. Sabean's Elephant	619	40	9. Reeve's Rose	575	40
4. Daisy	597	40	10. Burnaby Seedling	561	..
5. State of Maine	597	40	11. White Beauty	553	40
6. Prolific Rose	590	20	12. Brownell's Winner	546	20

An average crop of 597 bushels 3 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Carman, No. 1	663	28	7. General Gordon	612	16
2. Green mountain	657	4	8. Country Gentleman	610	3
3. Maggie Murphy	644	16	9. Delaware	603	44
4. Carman, No. 3	629	20	10. American Giant	599	52
5. Northern Spy	616	32	11. American Wonder	599	28
6. Rural Blush	615	..	12. Dakota Red	595	12

An average crop of 620 bushels 31 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Uncle Sam	686	24	7. American Giant	662	12
2. Dakota Red	682	..	8. McIntyre	660	..
3. Polaris	677	36	9. Holborn Abundance	651	12
4. Vanier	675	24	10. Vick's Extra Early	633	36
5. Money Maker	673	12	11. Bovee	629	12
6. Swiss Snow Flake	673	12	12. New Variety, No. 1	629	12

An average crop of 661 bushels 5 lbs. per acre.

The twelve varieties of potatoes which have produced the largest crops in 1901, taking the average of the results obtained at all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Sabean's Elephant	509	1	7. Money Maker	488	40
2. Burnaby Seedling	501	2	8. Clay Rose	485	34
3. Uncle Sam	499	14	9. Dreer's Standard	484	16
4. Late Puritan	495	34	10. Holborn Abundance	482	9
5. I. X. L.	492	31	11. Carman, No. 1	482	3
6. Hale's Champion	491	8	12. American Giant	480	55

An average crop of 496 bushels 1 lb. per acre.

The average crop of all the varieties of potatoes tested at each of the experimental farms was as follows:—At Ottawa, 380 bushels 21 lbs. per acre ; Nappan, 294 bushels; Brandon, 468 bushels 52 lbs.; Indian Head, 480 bushels 26 lbs.; and at Agassiz, 528 bushels 30 lbs. The average return given, including all the varieties on the whole of the farms, was 430 bushels 26 lbs. per acre.

AVERAGE OF CROPS FOR THE LAST FOUR TO SEVEN YEARS.

The results of experiments with different varieties of the more important agricultural crops to ascertain their relative productiveness become much more reliable and conclusive when the average experience of a series of years can be given. In this way variations arising from inequality of soil and variability of season are, to a large extent equalized and the conclusions reached become a much more valuable guide to the farmer in his selection of seed. The longer the experiments are continued, the more accurate are the indications which can be given. The experiences here recorded with most of the crops under test now cover a period of from five to seven years.

SIX AND SEVEN YEARS' EXPERIENCE WITH VARIETIES OF OATS.

The twelve varieties of oats which have averaged the heaviest crops at the several experimental farms during the past six and seven years are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Average for seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Banner	65	30	7. Columbus	61	11
2. American Triumph	64	7	8. Golden Beauty	60	22
3. Joanette	63	11	9. Oderbruch	60	13
4. Holstein Prolific	63	7	10. Improved Ligowo	60	11
5. American Beauty	61	24	11. Abundance	59	29
6. Golden Giant	61	16	12. Hazlett's Seizure	59	20

An average crop of 61 bushels 28 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

Average for six and seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Wallis	73	7	7. Banner	69	8
2. White Russian	71	6	8. White Schonen	68	13
3. Oderbruch	70	23	9. Golden Beauty	68	11
4. Lincoln	70	..	10. Abyssinia	68	8
5. Cream Egyptian	69	14	11. American Beauty	67	25
6. Early Blossom	69	11	12. Pense, 6 yrs	67	25

An average crop of 69 bushels 15 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

Average for six years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. American Beauty	95	32	7. Holstein Prolific	83	15
2 Banner	92	24	8. Golden Giant	83	4
3. Bavarian	92	4	9. American Triumph	82	9
4 Early Golden Prolific	85	2	10. Abundance	79	1
5. Golden Beauty	83	26	11. Columbus	78	6
6. White Schonen	83	26	12. Lincoln	78	1

An average crop of 84 bushels 27 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

Average for six years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Abundance	95	15	7. Early Golden Prolific	89	2
2 American Beauty	95	9	8. American Triumph	88	31
3. Columbus	93	22	9. Banner	88	30
4 Holstein Prolific	92	14	10. Bavarian	87	22
5. Golden Beauty	90	28	11. Early Archangel	86	3
6. Wide Awake	89	31	12. Abyssinia	85	7

An average crop of 90 bushels 9 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

Average for six and seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Golden Giant	68	18	7. Holstein Prolific	62	14
2. Banner	65	15	8. Early Golden Prolific	61	33
3. Lincoln	64	28	9. Abyssinia	61	17
4. Buckbee's Illinois, 6 yrs	63	31	10. Bavarian	60	27
5. Early Blossom	63	19	11. Oderbruch	60	23
6. Early Gothland	62	28	12. Prolific Black Tartarian	60	3

An average crop of 63 bushels 1 lb. per acre.

The twelve varieties of oats which have produced the largest average crop for the past six or seven years on all the experimental farms, and hence may, perhaps, be regarded as worthy of being placed at the head of the list for general cultivation in Canada, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Banner	76	14	7. Golden Beauty	71	32
2. American Beauty	75	33	8. Columbus	71	17
3. Mennonite	75	23	9. Golden Giant	71	8
4. Holstein Prolific	72	31	10. Early Golden Prolific	71	..
5. Bavarian	72	21	11. Abundance	70	20
6. Buckbee's Illinois	72	4	12. American Triumph	70	20

An average crop of 72 bushels 24 lbs. per acre.

SIX AND SEVEN YEARS' EXPERIENCE WITH VARIETIES OF BARLEY.

TWO-ROWED BARLEY.

The six varieties of two-rowed barley, which have averaged the heaviest crops at the several experimental farms during the past six or seven years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Average for seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Beaver	45	22	4. French Chevalier	42	45
2. Canadian Thorpe	44	24	5. Nepean	41	9
3. Danish Chevalier	44	..	6. Sidney	40	38

An average crop of 43 bushels 7 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

Average for seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Beaver	44	40	4. Newton	41	8
2. French Chevalier	43	4	5. Canadian Thorpe	40	40
3. Danish Chevalier	41	41	6. Nepean	40	..

An average crop of 41 bushels 46 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

Average for five and six years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. French Chevalier	46	25	4. Bolton	43	29
2. Sidney	45	32	5. Newton	42	31
3. Nepean	44	41	6. Victor, 5 yrs	42	16

An average crop of 44 bushels 13 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

Average for six years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. French Chevalier	59	41	4. Canadian Thorpe	54	32
2. Danish Chevalier	58	13	5. Sidney	54	8
3. Prize Prolific	54	33	6. Bolton	51	19

An average crop of 55 bushels 24 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

Average for seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Canadian Thorpe	38	13	4. Danish Chevalier	37	21
2. French Chevalier	38	12	5. Kinver Chevalier	37	9
3. Beaver	38	11	6. Prize Prolific	36	38

An average crop of 37 bushels 33 lbs. per acre.

The six varieties of two-rowed barley which have produced the largest crops for the past six or seven years, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. French Chevalier	46	6	4. Canadian Thorpe	43	26
2. Beaver	43	39	5. Nepean	42	7
3. Danish Chevalier	43	31	6. Newton	42	3

An average crop of 43 bushels 27 lbs. per acre.

SIX-ROWED BARLEY.

The six varieties of six-rowed barley which have averaged the heaviest crops at the several experimental farms for the past six or seven years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Average for seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Odessa	53	14	4. Pioneer	49	19
2. Mensury	52	20	5. Stella	45	41
3. Royal	50	26	6. Oderbruch	45	24

An average crop of 49 bushels 24 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

Average for seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury	52	29	4. Baxter	44	28
2. Odessa	45	32	5. Trooper	44	11
3. Oderbruch	45	29	6. Surprise	43	31

An average crop of 46 bushels 3 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

Average for six years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury	54	1	4. Nugent	50	15
2. Trooper	52	25	5. Summit	50	2
3. Common	51	29	6. Surprise	48	31

An average crop of 51 bushels 9 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

Average for six years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Odessa	61	19	4. Trooper	58	26
2. Rennie's Improved	60	28	5. Common	57	3
3. Mensury	59	41	6. Baxter	56	17

An average crop of 58 bushels 46 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

Average for six and seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury	39	8	4. Odessa	37	29
2. Baxter, 6 yrs	38	7	5. Common	37	9
3. Royal	37	37	6. Nugent	35	32

An average crop of 37 bushels 28 lbs. per acre.

The six varieties of six-rowed barley which have produced the largest crops for the past six or seven years, taking the average of the results obtained at all the experimental farms, are the following :—

	Per acre. Bush.	L		Per acre. Bush.	Lbs.
1 Mensury	51	29	4. Common	46	38
2 Odessa	48	19	5. Royal	46	32
3. Trooper	47	4	6. Oderbruch	45	35

An average crop of 47 bushels 34 lbs. per acre.

FIVE TO SEVEN YEARS' EXPERIENCE WITH VARIETIES OF SPRING WHEAT.

The twelve varieties of spring wheat which have averaged the heaviest crops at the several experimental farms during the past five to seven years are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Average for six and seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Preston	28	31	7. Rio Grande	25	3
2. Wellman's Fife	26	37	8. Pringle's Champlain	24	48
3. Huron	26	15	9. Monarch	24	27
4. Goose	26	8	10. White Fife	23	57
5. Colorado	25	29	11. Stanley	23	46
6. Hungarian, 6 yrs	25	26	12. Crown	23	38

An average crop of 25 bushels 21 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

Average for six and seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1 White Connell	34	43	7. Rio Grande	32	23
2. Monarch, 6 yrs	34	26	8. Advance	32	14
3. Wellman's Fife	34	6	9. Red Fern	32	14
4. Preston	33	11	10. Huron	31	59
5. Hungarian	33	2	11. Goose	31	54
6. White Russian	32	54	12. Stanley	31	34

An average crop of 32 bushels 53 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

Average for five and six years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Goose	40	48	7. Pringle's Champlain	35	38
2. White Fife	38	17	8. White Connell	35	23
3. Crown	37	35	9. Rio Grande	35	5
4. Red Fife	37	5	10. White Russian	34	38
5. Monarch	36	57	11. Wellman's Fife	34	5
6. Preston, 5 yrs	35	41	12. Advance	33	52

An average crop of 36 bushels 15 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

Average for six years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Huron	44	32	7. Percy	42	22
2. Red Fife	44	12	8. Stanley	41	57
3. Wellman's Fife	43	17	9. White Fife	41	38
4. Beaudry	43	2	10. Monarch	41	17
5. Red Fern	42	45	11. Alpha	41	7
6. Preston	42	43	12. Rio Grande	40	50

An average crop of 42 bushels 28 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

Average for six and seven years.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Countess, 6 yrs	30	10	7. Monarch	28	35
2. Preston	29	45	8. Dufferin, 6 yrs	28	32
3. Hungarian, 6 yrs	29	2	9. Dawn, 6 yrs	28	30
4. Huron	28	53	10. Alpha	28	7
5. Vernon, 6 yrs	28	40	11. Red Fern	28	6
6. Red Fife	28	37	12. Progress	27	48

An average crop of 28 bushels 44 lbs. per acre.

The twelve varieties of spring wheat which have produced the largest crops for the past six or seven years, taking the average of the results obtained on all the experimental farms, are :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Preston	33	58	7. White Fife	32	29
2. Wellman's Fife	33	8	8. Hungarian	32	10
3. Monarch	33	8	9. White Connell	32	6
4. Goose	32	50	10. White Russian	32	6
5. Huron	32	45	11. Rio Grande	32	6
6. Red Fife	32	30	12. Pringle's Champlain	31	56

An average crop of 32 bushels 36 lbs. per acre.

FOUR TO SEVEN YEARS' EXPERIENCE WITH VARIETIES OF PEASE.

The twelve varieties of pease which have averaged the heaviest crops at the several experimental farms, for the past four to seven years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Arthur, 6 yrs	37	35	7. Mummy, 6 yrs	32	55
2. Canadian Beauty, 5 yrs	35	34	8. Black-eyed Marrowfat, 6 yrs	32	45
3. Kent, 5 yrs	34	38	9. Agnes, 6 yrs	32	38
4. Paragon, 6 yrs	34	32	10. Prussian Blue, 7 yrs	32	22
5. Duke, 6 yrs	33	45	11. Mackay, 6 yrs	32	23
6. Macoun, 5 yrs	33	44	12. Creeper, 6 yrs	32	15

An average crop of 33 bushels 46 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs		Per acre. Bush.	Lbs.
1. Crown, 6 yrs	39	50	7. Agnes, 5 yrs	30	4
2. Pride, 5 yrs	36	20	8. Carleton, 5 yrs	30	3
3. Centennial, 6 yrs	33	7	9. Paragon, 5 yrs	29	15
4. New Potter, 6 yrs	32	17	10. Multiplier, 6 yrs	28	50
5. Black-eyed Marrowfat, 6 yrs	32	..	11. Perth, 4 yrs	28	45
6. Duke, 5 yrs	30	27	12. Archer, 4 yrs	28	25

An average crop of 31 bushels 37 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Pride, 7 yrs	45	26	7. Trilby, 6 yrs	42	8
2. Carleton, 6 yrs	44	50	8. Crown, 6 yrs	41	53
3. Mummy, 7 yrs	44	40	9. Kent, 6 yrs	40	37
4. New Potter, 7 yrs	42	44	10. Prussian Blue, 5 yrs	40	6
5. White Wonder, 5 yrs	42	42	11. Archer, 5 yrs	40	4
6. King, 5 yrs	42	28	12. Mackay, 6 yrs	39	53

An average crop of 42 bushels 17 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Trilby, 5 yrs....	43	8	7. Archer, 4 yrs...	38	47
2. Paragon, 5 yrs...	42	50	8. Prince Albert, 5 yrs..	37	50
3. Crown, 5 yrs..	41	30	9. King, 4 yrs..	37	40
4. Carleton, 5 yrs..	40	46	10. Duke, 5 yrs..	37	38
5. White Wonder, 4 yrs....	39	27	11. Perth, 4 yrs..	37	30
6. Pride, 5 yrs...	38	52	12. Macoun, 5 yrs..	37	16

An average crop of 39 bushels 26 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. White Wonder, 5 yrs..	37	22	7. Elephant Blue, 5 yrs....	33	42
2. King, 5 yrs...	37	8	8. Vincent, 5 yrs....	33	10
3. Early Britain, 5 yrs...	36	39	9. Chancellor, 5 yrs..	32	40
4. Victoria, 5 yrs..	35	27	10. Harrison's Glory, 5 yrs....	32	35
5. Perth....	34	36	11. Archer, 5 yrs..	32	33
6. Arthur, 6 yrs....	34	8	12. Prussian Blue, 5 yrs....	32	31

An average crop of 34 bushels 23 lbs. per acre.

The twelve varieties of pease which have produced the largest crops for the past four to seven years, taking the average of the results obtained at all the experimental farms, are :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Crown, 7 yrs..	36	40	7. Paragon, 6 yrs..	34	26
2. Pride, 7 yrs...	36	..	8. Duke, 6 yrs..	34	23
3. Carleton, 6 yrs..	35	36	9. Perth, 5 yrs..	33	53
4. Early Britain, 5 yrs..	34	53	10. Agnes, 6 yrs..	33	52
5. King, 5 yrs....	34	36	11. Archer, 5 yrs...	33	50
6. New Potter, 7 yrs..	34	30	12. Arthur, 6 yrs...	33	7

An average crop of 34 bushels 41 lbs. per acre.

FIVE TO SEVEN YEARS' EXPERIENCE WITH VARIETIES OF INDIAN CORN.

The six varieties of Indian corn which have averaged the heaviest crops at the several experimental farms, during the past five to seven years, are the following. (Where not otherwise marked, the figures given are the results of seven years' tests) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Cob Ensilage..	24	599	4. Cloud's Early Yellow, 5 yrs.. ..	23	1,745
2. Rural Thoro'bred White Flint....	23	1,937	5. Selected Leaming, 6 yrs...	23	136
3. Giant Prolific Ensilage...	23	1,901	6. Champion White Pearl..	21	172

An average crop of 23 tons 748 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Rural Thoro'bred White Flint....	17	1,245	4. Sanford...	15	1,801
2. Red Cob Ensilage..	16	1,030	5. Pride of the North...	15	1,529
3. Selected Leaming, 6 yrs..	16	578	6. Angel of Midnight....	15	1,326

An average crop of 16 tons 585 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Rural Thoro'bred White Flint...	21	1,635	4. Longfellow..	19	946
2 Angel of Midnight..	20	986	5. Red Cob Ensilage..	18	1,978
3. Cloud's Early Yellow, 5 yrs.... ..	19	1,020	6. King of the Earliest, 6 yrs... ..	18	1,517

An average crop of 19 tons 1,680 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Cloud's Early Yellow, 5 yrs... ..	15	622	4. Pride of the North...	13	1,250
2. Early Butler, 5 yrs....	14	976	5. Selected Leaming, 6 yrs....	13	888
3. Giant Prolific Ensilage...	13	1,842	6. Mammoth 8-rowed Flint...	13	139

An average crop of 13 tons 1,953 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Butler, 5 yrs....	24	780	4. Selected Leaming, 6 yrs...	21	1,942
2. Red Cob Ensilage..	23	1,652	5. King of the Earliest, 6 yrs.... ..	20	1,575
3. Cloud's Early Yellow, 5 yrs... ..	23	442	6. Pride of the North...	20	1,305

An average crop of 22 tons 949 lbs. per acre.

The six varieties of Indian corn which have produced the largest crops for the past five to seven years, taking the average of the results obtained on all the experimental farms, are :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Cloud's Early Yellow, 5 yrs... ..	19	1,001	4. Selected Leaming, 6 yrs...	18	1,210
2. Red Cob Ensilage..	19	651	5. Early Butler, 5 yrs...	18	958
3. Rural Thoro'bred White Flint....	19	134	6. Giant Prolific Ensilage..	17	1,976

An average crop of 18 tons 1,655 lbs. per acre.

FIVE AND SIX YEARS' EXPERIENCE WITH VARIETIES OF TURNIPS.

The six varieties of turnips which have averaged the heaviest crops at the several experimental farms, during the past five and six years, are the following. (Where not otherwise marked, the figures given are the results of six years' tests) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1 Carter's Elephant..	36	317	4. Shamrock Purple Top, 5 yrs....	33	1,649
2. Selected Purple Top..	35	1,747	5. Hall's Westbury, 5 yrs..	33	33
3. Perfection Swede...	33	1,790	6. Hartley's Bronze..	32	1,670

An average crop of 33 tons 1,856 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Hartley's Bronze...	35	1,824	4. Carter's Elephant....	34	1,078
2. Halewood's Bronze Top, 5 yrs....	34	1,927	5. Shamrock Purple Top, 5 yrs.. ..	33	1,779
3. Perfection Swede...	34	1,569	6. Mammoth Clyde..	33	81

An average crop of 34 tons 1,043 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Hartley's Bronze...	24	1,315	4. Selected Purple Top....	23	728
2. Hall's Westbury, 5 yrs..	23	1,137	5. Prize Winner..	23	557
3. Perfection Swede..	23	838	6. Skirvings..	22	1,452

An average crop of 23 tons 245 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Perfection Swede..	23	362	4. Hall's Westbury, 5 yrs..	22	298
2. Halewood's Bronze Top..	22	849	5. Hartley's Bronze..	21	430
3. Selected Purple Top..	22	771	6. Shamrock Purple Top, 5 yrs.. ..	20	1,858

An average crop of 22 tons 95 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Bangholm Selected....	44	1,136	4. Hall's Westbury..	40	612
2. Halewood's Bronze Top, 5 yrs....	41	1,084	5. Perfection Swede..	40	450
3. Selected Purple Top..	41	197	6. Jumbo..	39	856

An average crop of 41 tons 564 lbs. per acre.

The six varieties of turnips which have averaged the heaviest crops at the several experimental farms, for the past five and six years, are :—

	Per acre. Tons.	Lbs		Per acre. Tons.	Lbs.
1. Purple Top Swede..	31	206	4. Hall's Westbury' 5 yrs..	30	579
2. Perfection Swede...	31	202	5. Hartley's Bronze..	29	1,700
3. Halewood's Bronze Top, 5 yrs....	30	783	6. Bangholm Selected, 5 yrs..	29	1,648

An average crop of 30 tons 853 lbs. per acre.

FIVE AND SIX YEARS' EXPERIENCE WITH VARIETIES OF MANGELS.

The six varieties of mangels which have averaged the heaviest crops at the several experimental farms, for the past five or six years, are the following. (Where not otherwise marked, the figures given are the results of six years' tests) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Gate Post..	39	961	4. Yellow Intermediate...	36	1,525
2. Giant Yellow Intermediate..	38	1,587	5. Giant Yellow Globe..	35	1,609
3. Mammoth Long Red...	36	1,920	6. Giant Yellow Half Long, 5 yrs..	35	1,037

An average crop of 37 tons 440 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant Yellow Intermediate.... ..	34	425	4. Giant Yellow Globe..	32	283
2. Yellow Intermediate..	32	1,505	5. Giant Yellow Half Long, 5 yrs..	32	278
3. Norbiton Giant..	32	420	6. Gate Post....	31	1,616

An average crop of 32 tons 1,088 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Selected Mamm. Long Red, 5 yrs.	36	1,141	4. Gate Post, 5 yrs...	32	1,548
2. Yellow Intermediate..	34	423	5. Prize Mammoth Long Red.... ..	32	1,516
3. Giant Yellow Intermediate.... ..	33	1,638	6. Mammoth Long Red....	31	1,876

An average crop of 33 tons 1,357 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Selected Mamm. Long Red, 5 yrs.	23	808	4. Champion Yellow Globe....	22	1,750
2. Giant Yellow Half Long, 5 yrs...	23	582	5. Gate Post....	22	939
3. Yellow Intermediate, 5 yrs..	23	91	6. Ward's Large Oval-shaped... ..	22	832

An average crop of 22 tons 1,842 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Yellow Intermediate, 5 yrs.... ..	34	1,934	4. Giant Yellow Half Long, 5 yrs..	29	1,959
2. Giant Yellow Intermediate, 6 yrs.	32	1,272	5. Gate Post, 6 yrs...	28	1,738
3. Selected Mamm. Long Red, 5 yrs.	30	1,248	6. Mammoth Long Red, 5 yrs..	28	23

An average crop of 30 tons 1,696 lbs. per acre.

The six varieties of mangels which have produced the largest crops for the past five or six years, taking the average of the results obtained at all the experimental farms, are :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Yellow Intermediate.....	32	696	4. Selected Mammoth Long Red....	30	578
2. Giant Yellow Intermediate.... ..	32	254	5. Mammoth Yellow Intermediate.	29	1,841
3. Gate Post..	31	160	6 Giant Yellow Half Long...	29	1,100

An average crop of 30 tons 1,771 lbs. per acre.

FIVE AND SIX YEARS' EXPERIENCE WITH VARIETIES OF CARROTS.

The six varieties of carrots which have produced the heaviest crops at the several experimental farms, for the past five or six years, are the following. (Where not otherwise marked, the figures given are the results of six years' tests) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant White Vosges...	30	1,193	4. Improved Short White..	29	373
2. Mammoth White Intermediate. ..	29	1,675	5. Iverson's Champion..	29	300
3. Half Long White...	29	556	6. Green Top White Orthe, 5 yrs..	27	21

An average crop of 29 tons 353 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth White Intermediate...	22	640	4. Green Top White Orthe...	20	1,773
2. Giant White Vosges...	21	1,385	5. Improved Short White..	20	902
3. Half Long White...	21	1,303	6. Iverson's Champion..	19	650

An average crop of 20 tons 1,442 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant White Vosges...	14	563	4. Mamm. White Intermediate, 5 yrs.	13	418
2 Half Long White...	14	270	5. Early Gem....	12	1,410
3. Iverson's Champion...	13	473	6. White Belgian...	12	1,080

An average crop of 13 tons 702 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Improved Short White, 5 yrs.. ..	11	1,353	4. Mamm. White Intermediate, 5 yrs.	10	942
2. Half Long White, 5 yrs..	11	1,153	5. Green Top White Orthe, 5 yrs....	10	594
3. Iverson's Champion, 5 yrs..	11	584	6. White Belgian...	10	354

An average crop of 10 tons 1,830 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Improved Short White...	33	1,087	4. Green Top White Orthe...	29	1,462
2. Giant White Vosges..	31	1,664	5. Yellow Intermediate....	28	1,448
3. Half Long White...	31	968	6. Iverson's Champion..	28	999

An average crop of 30 tons 1,271 lbs. per acre.

The six varieties of carrots which have produced the largest crops during the past five or six years, taking the average of the results obtained on all the experimental farms, are :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Half Long White...	21	1,250	4. Mammoth White Intermediate...	20	1,705
2. Giant White Vosges...	21	1,245	5. Iverson's Champion..	20	601
3. Improved Short White...	21	637	6. Green Top White Orthe...	19	1,601

An average crop of 20 tons 1,840 lbs. per acre.

FOUR AND FIVE YEARS' EXPERIENCE WITH VARIETIES OF SUGAR BEETS.

The four varieties of sugar beets which have averaged the heaviest crops at the several experimental farms, for the past four or five years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Improved	26	1,735	3. Wanzleben	25	1,496
2. Improved Imperial	26	968	4. Danish Red Top	25	284

An average crop of 26 tons 40 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Top Sugar	27	950	3. Improved Imperial	26	402
2. Danish Red Top	26	487	4. Danish Improved	23	575

An average crop of 25 tons 1,613 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top	31	1,013	3. Red Top Sugar	25	426
2. Danish Improved	26	1,077	4. Wanzleben	25	93

An average crop of 27 tons 152 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top	19	225	3. Improved Imperial	15	1,270
2. Red Top Sugar	16	1,446	4. Wanzleben	15	789

An average crop of 16 tons 1,432 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top, 3 yrs	28	1,222	3. Red Top Sugar	21	536
2. Improved Imperial	22	528	4. Vilmorin's Improved	20	1,696

An average crop of 23 tons 495 lbs. per acre.

The four varieties of sugar beets which have produced the largest crops during the past four or five years, taking the average of the results obtained at all the experimental farms, are :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top	26	246	3. Danish Improved	22	1,091
2. Red Top Sugar	23	172	4. Improved Imperial	22	782

An average crop of 23 tons 1,075 lbs. per acre.

FIVE TO SEVEN YEARS' EXPERIENCE WITH VARIETIES OF POTATOES.

The twelve varieties of potatoes which have averaged the heaviest crops at the several experimental farms, during the past five to seven years, are the following. (Where not otherwise marked, the figures given are the results of seven years' tests) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs		Per acre. Bush.	Lbs.
1. Holborn Abundance	424	51	7. Dreer's Standard	373	34
2. Seattle	422	59	8. Everett	373	2
3. American Wonder	418	8	9. State of Maine	369	50
4. Late Puritan	406	1	10. Polaris	368	59
5. Seedling, No. 230	388	8	11. Vanier	368	30
6. Burnaby Seedling	381	48	12. Empire State	368	15

An average crop of 388 bushels 40 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Seedling, No. 30, 6 yrs	436	8	7. Pearce's Prize Winner, 6 yrs	384	24
2. Irish Daisy	431	4	8. Pride of the Market	384	..
3. Holborn Abundance	422	49	9. Carman, No. 1	383	19
4. Seattle, 6 yrs	410	3	10. Vanier, 6 yrs	374	33
5. American Giant, 5 yrs	401	58	11. Dreer's Standard	366	18
6. Hale's Champion, 6 yrs	389	39	12. Great Divide	365	59

An average crop of 395 bushels 51 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Carman, No. 1	394	57	7. Clarke's No. 1	379	46
2. Irish Daisy, 6 yrs	394	10	8. Late Puritan	379	14
3. State of Maine	389	27	9. Great Divide	372	57
4. Delaware, 6 yrs	388	40	10. Early Norther, 6 yrs	365	10
5. American Wonder, 5 yrs	387	11	11. New Variety, No. 1	363	37
6. Dreer's Standard	383	57	12. Pearce's Prize Winner, 6 yrs	363	37

An average crop of 380 bushels 14 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. American Giant, 6 yrs	494	50	7. Lee's Favourite, 6 yrs	415	21
2. American Wonder	458	6	8. Carman, No. 1	408	51
3. New Variety, No. 1, 6 yrs	436	4	9. Seedling, No. 230	406	33
4. General Gordon, 5 yrs	431	24	10. Lizzie's Pride	405	20
5. Rochester Rose, 6 yrs	430	59	11. State of Maine	404	42
6. Northern Spy	415	44	12. Green Mountain	404	41

An average crop of 426 bushels 3 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Rose, No. 9, 5 yrs	424	..	7. Vick's Extra Early	389	10
2. Dakota Red	404	48	8. Houlton Rose	385	55
3. Seedling, No. 7	402	21	9. Clay Rose	385	3
4. Seedling, No. 230	398	4	10. Bill Nye, 5 yrs	374	43
5. Carman, No. 3	391	1	11. Reeve's Rose, 5 yrs	373	29
6. Brown's Rot Proof	390	15	12. Irish Daisy	366	25

An average crop of 390 bushels 26 lbs. per acre.

The twelve varieties of potatoes which have produced the largest crops, taking the average of the results obtained on all the experimental farms for the past five to seven years, are :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1 Seedling, No. 230	391	43	7. Late Puritan	369	14
2. Everett	390	41	8. Carman, No. 1	367	22
3. Seedling, No. 7, 5 yrs	386	26	9. Carman, No. 3, 5 yrs	366	40
4. Irish Daisy	384	56	10. Rose, No. 9, 5 yrs	366	33
5. American Wonder	384	6	11. Seattle	364	43
6. American Giant	383	17	12. Empire State	363	11

An average crop of 376 bushels 34 lbs. per acre.

SUMMARY.

The results of the testing of varieties for another year strengthens the conclusions reached in the past as to the importance of chosing the best and most productive sorts for seed if we are to realize the largest crops. Further experience also confirms the view that there are marked and fairly constant differences in the productiveness of varieties grown side by side, under similar conditions. A few points in support of this will be cited.

Of the 41 different sorts of oats which have now been under trial for six or seven years at all the Dominion experimental farms, only 18 of these have at any time appeared in the list of the best twelve. Hence many of the same varieties appear every year in the productive list. The average crop given by these 12 best sorts for the past six or seven years has been 72 bushels 24 lbs. per acre, while the remaining 29 varieties have averaged during the same time 66 bushels 2 lbs., a difference in favour of the most productive sorts of 6 bushels 22 lbs. per acre. This receives additional significance when we recall the fact that every bushel of oats added to the average crop of the Dominion puts about one million dollars into the pockets of Canadian farmers.

In barley this constancy in productiveness is even more marked. Of the 30 different sorts which have been under trial for the past six and seven years, 10 of these have appeared in the best 12 every year for the whole period and 14 only have found their way during this time into the list of the best twelve. While the 12 most productive sorts have given an average crop for the whole period of 45 bushels 30 lbs. per acre, the remaining 22 sorts have averaged for the same period 41 bushels 45 lbs., or nearly four bushels less per acre.

In the returns for the trial plots of spring wheat similar evidence is found. Of the 31 varieties of this cereal which have been tested for six or seven consecutive years, 8 of these have appeared among the most productive every year for the whole period. Comparing the best twelve varieties for 1899 with the best twelve for 1900, we find that eleven of them are the same, and comparing the best twelve for 1900 with that for 1901, we find the lists exactly the same.

Similar evidence could be furnished from the trial plots of all the other crops, but enough has been brought forward to show that the opinions advanced are well founded. Should it become a general practice among farmers to choose for sowing those varieties which have been shown to be most productive and give them reasonably fair cultivation, there is no doubt that this would result in a material increase in the average crops of the country and thus make farming increasingly profitable.

S
133
.E22

nos. 40 - 49

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

CLOVER AS A FERTILIZER

BY

WILLIAM SAUNDERS, LL.D.
Director of Experimental Farms

AND

FRANK T. SHUTT, M.A.
Chemist, Dominion Experimental Farms

BULLETIN No. 40

JULY, 1902

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE

In the returns for the trial plots of spring wheat similar evidence is found. Of the 31 varieties of this cereal which have been tested for six or seven consecutive years, 8 of these have appeared among the most productive every year for the whole period. Comparing the best twelve varieties for 1899 with the best twelve for 1900, we find that eleven of them are the same, and comparing the best twelve for 1900 with that for 1901, we find the lists exactly the same.

Similar evidence could be furnished from the trial plots of all the other crops, but enough has been brought forward to show that the opinions advanced are well founded. Should it become a general practice among farmers to choose for sowing those varieties which have been shown to be most productive and give them reasonably fair cultivation, there is no doubt that this would result in a material increase in the average crops of the country and thus make farming increasingly profitable.

?133
.E22

nos. 40-49

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

CLOVER AS A FERTILIZER

BY

WILLIAM SAUNDERS, LL.D.
Director of Experimental Farms

AND

FRANK T. SHUTT, M.A.
Chemist, Dominion Experimental Farms

BULLETIN No. 40

JULY, 1902

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE

CONTENTS.

	PAGE.
Letter of transmittal	3
Loss of plant food	5
Large stores of plant food in the soil	5
Soil exhaustion by growing crops	6
Humus, functions of	7
" waste of	7
The mechanical condition of the soil	7
Clover, value of, as a fertilizer	8
" influence of, on farm crops	9
Increase in yield due to ploughing under of clover	9
Banner Oats, from plots, in 1898	9, 10
Mensury Barley, from plots, the second year from the ploughing under of clover, in 1899	11
Average increase in grain and straw for the first and second year	11
Bavarian Oats, field crop, in 1899	12
New Zealand Oats, from plots, in 1900	12
Banner Oats, from plots, in 1901	13
Indian Corn, Longfellow, from plots, in 1898	14
" " " in 1900	15
" Selected Leaming, " in 1901	16
Potatoes, Daisy, from plots, in 1899	16
" Rochester Rose, from plots, in 1900	17
" Everett, " in 1901	17
Clover sown with grain does not lessen the yield of grain	18
Quantity of seed and variety of clover for best results	18
Value of winter-killed clover	20
Clover compared with barnyard manure as a fertilizer	21
Fertilizers for clover	22
Summary	23

To the Honourable
The Minister of Agriculture.

SIR,—I have the honour to submit for your approval Bulletin No. 40 of the Experimental Farm series on 'Clover as a Fertilizer.' This has been prepared jointly by Mr. Frank T. Shutt, Chemist of the Dominion Experimental Farms, and myself.

The question of the maintenance of the fertility of soils is one of the utmost importance to farmers. The soils of a country are a natural resource of immense and permanent value, which should be so treated as to increase rather than lessen in value as time goes on. Where soils have had their productiveness impaired by careless farming, they may be rapidly improved or gradually restored to fertility by occasional dressings of barn-yard manure and the ploughing under of crops of green clover Such treatment will also be found of inestimable value in maintaining the fertility of farm lands generally. In Bulletin No. 40 evidence is submitted gathered chiefly from the experimental work conducted for some years past at the Central Experimental Farm, as to the usefulness of clover for this purpose. It is believed that this information will be of much value to farmers in all those parts of the Dominion where clover can be successfully grown.

I have the honour to be, sir,

Your obedient servant,

WM. SAUNDERS,
Director Experimental Farms.

OTTAWA, July 7, 1902.

PLATE I.

CLOVER: 2ND YEAR'S GROWTH. Illustrating extensive root system.

	Tons.	Lbs.
Foliage	13	1,640
Roots (to a depth of 2½ ft.).....	6	112

June 24, 1902.

CLOVER AS A FERTILIZER

BY

WILLIAM SAUNDERS, LL.D.,

Director of Experimental Farms,

AND

FRANK T. SHUTT, M.A., F.C.S.,

Chemist, Experimental Farms.

All practical and observant farmers know that the producing power of soils is steadily reduced when successive crops are grown and no adequate return of manure or other fertilizer made. It is also generally known that this exhaustion of fertility is more rapid when no regular system of rotation is followed. Why is this? The reasons are these: First, there is the withdrawal of plant food by the growing crops; and second, the gradual loss of humus or organic matter, which brings about an unfavourable condition of the soil. We hope to show in this bulletin that the growing and ploughing under of clover may be employed to lessen or prevent these effects of wasteful farming.

Loss of Plant Food.

Plants take the food necessary for their maintenance and growth from two sources—the air and the soil. Hence, every crop harvested must lessen the store of plant food in the soil and leave it more or less impoverished. The elements thus withdrawn are chiefly nitrogen, phosphoric acid, potash and lime. These are found in large proportions in most soils, where they exist in two conditions—soluble or readily available, and insoluble and hence unavailable. Only a small percentage of the total amount of plant food in a soil exists in the more soluble and valuable form; much the larger part is locked up, and hence is of no immediate value to growing crops. By the practice of good methods of cultivation, such as are usually followed by the industrious farmer, portions of the insoluble plant food are gradually changed into soluble and available material. Where no systematic efforts are made to maintain the fertility of the land, and where there is also a neglect of cultivation, the small proportion of plant food existing in soluble forms in the soil is soon so far exhausted that satisfactory crops cannot be grown, and such land is often regarded as worn out and useless. The fact is that usually it is only the soluble plant food which is exhausted; the larger portion, in insoluble form, is still ready to respond to good farming, by which it may be gradually brought to such condition as will result in profitable returns.

Large Stores of Fertility in the Soil.

It has been estimated from the results of many analyses that good average agricultural lands in Europe contain of these important elements of fertility, in each acre of soil a foot deep, about the following proportions:—Nitrogen, 3,500 lbs. or more; phosphoric acid, from 3,000 to 6,000 lbs.; and potash, 5,000 to 8,000 lbs. Analyses made at the Experimental

Farm Laboratories during the past twelve years clearly show that the soils of Canada compare most favourably with those of Europe as regards the quantities of these essential constituents. Lime is also present in widely varying proportions. Where a soil has been partly or largely formed from the disintegration of lime-stone rocks, this element is usually present in sufficient quantity for all the requirements of plant growth for many years; but where the rocks from which the soil has been mainly derived contain little or no lime, this ingredient is sometimes deficient. Where lime forms less than one per cent it is deemed wise to give an occasional dressing of this substance, especially to such soils as are of a clayey nature.

Soil Exhaustion by Growing Crops.

The extent or rate of soil exhaustion from cropping is indicated by the particulars in the following table, which gives the approximate amounts of the essential elements of fertility removed in ten years from an acre of land by ordinary farms crops, where the yields mentioned are obtained.

PLANT FOOD REMOVED BY CROPS IN TEN YEARS.

Yearly yield per acre.	Nitrogen.	Phosphoric Acid.	Potash.
	Lbs.	Lbs.	Lbs.
Timothy hay, two tons per acre.	600	400	900
Oats, 50 bushels per acre of grain with 2,200 lbs. of straw.	460	164	356
Spring wheat, 25 bushels of grain per acre with 2,200 lbs. of straw.	422	233	395
Barley, 35 bushels per acre of grain with 2,000 lbs. of straw.	325	164	270
Indian corn grown for fodder to the late milk or glazing stage, 15 tons per acre.	660	330	1,170
Turnips, roots only (the tops being left on the land to plough under), 15 tons per acre.	540	300	1,140
Mangels, roots only, 15 tons per acre.	570	270	1,149
Carrots, roots only, 15 tons per acre.	600	270	780
Sugar beets, roots only, 15 tons per acre.	630	240	1,110
Potatoes, tubers only, 200 bushels per acre.	408	192	684
Apples (trees in full bearing), fruit, leaves and wood.	650	150	900

We thus see that reduced yields must inevitably follow successive cropping (unless plant food is from time to time returned); for the amounts given in the above table represent for the most part withdrawals from that limited store of immediately available plant food to which we have already drawn attention. If, during the ten years referred to, the land has had regular dressings of barn-yard manure, say, once in five years, of about 20 tons to the acre, there would by this means be restored to the soil about 400 lbs. of nitrogen, 200 lbs. of phosphoric acid, and 360 lbs. of potash, with the further advantage of a large addition of humus. With a suitable rotation of crops this return would do much towards making up the losses mentioned.

The crop producing power of soils is also lessened under such circumstances as we have referred to, by the wasting of their organic matter. Humus,

which is the term applied to this semi-decomposed vegetable matter, results from the partial decay in the soil of roots and other parts of plants. Though not in itself a direct form of plant nourishment, it is nevertheless one of the most important constituents of all fertile soils.

Since the value of green manuring, that is the turning under of a growing crop, such, for instance, as clover, is partly due to the humus that it eventually furnishes, we may consider briefly the chief functions of this constituent.

Functions of Humus.

It is the natural storehouse and conservator of nitrogen, which element is the most expensive of all plant foods when it becomes necessary to purchase it in commercial fertilizers. Where humus is abundant in the soil, it is associated with a liberal supply of nitrogen, and it has been noticed that the amount of humus present gives an excellent indication of the quantity of organic nitrogen the soil contains. It has also been observed that as the humus disappears the nitrogen goes with it.

Humus furnishes the food upon which the micro-organisms in the soil live. These convert its organic nitrogen into nitrates, the compounds which alone can supply crops with their nitrogen.

It contains also considerable quantities of mineral food constituents. These, in the further decomposition of the humus,—a process continually going on in the summer when the soil is moist—are liberated in forms available to growing crops. In this way humus furnishes a large proportion of the potash, lime, &c., used by crops.

Humus increases the power of soils to absorb and hold moisture. This is a very important function. Since all the plant food furnished by the soil must be taken up in solution, the amount of water required by crops in their feeding is enormous. For every ton of dry matter produced in plants, it is estimated that about 325 tons of water are required. Hence, several hundred tons per acre are needed for the growing of a single crop.

It also regulates and protects against extremes of soil temperatures; opens up and mellows heavy soils, and serves materially to diminish the loss of fertilizing elements by drainage, and thus affects further improvement.

Waste of Humus.

Cultivation by ordinary farm methods, with plough, harrow, cultivator, &c., while most important and essential, exposes the soil to the action of the air and dissipates, to some extent, its humus. Further the bacteria which are constantly at work in soils have their power as regards the oxidation of organic matter increased by the operations necessary to produce a good mechanical condition of the soil. This means not only a loss of organic matter, but also of nitrogen. Soils in which grain is grown year after year lose, it is stated, much nitrogen by this oxidation of humus, and this loss is greatest in those soils which are richest in nitrogen.

The Mechanical Condition of the Soil.

Though it may be stated that the chief function of a soil is to furnish certain elements for the nourishment of crops, it is equally true that in order to give the best returns, a soil must be fairly retentive of moisture, must contain air, and must form a firm and suitable support for the growth of plants and allow an easy foraging ground for their roots. Such a soil is said to be in a good state of culture or tilth.

Soils differ greatly in their character, not only chemically, but mechanically. The three chief types are light porous sands, heavy clays, and peaty soils. The most fertile loams are those in which these three are blended, that is a proper admixture of sand, clay and humus. When sand

predominates, the soil is not so retentive of moisture, furnishes but a scant supply of plant food, and easily loses by oxidation and leaching a proportion of its most valuable constituents. Stiff plastic clays, which puddle in wet weather, and subsequently dry into hard lumps or masses, do not allow the air to permeate them or the growing roots to easily penetrate in search of the food they require. They may contain large quantities of plant food, but with such unfavourable mechanical conditions this food is of little value. Peaty soils are often sour (a property detrimental to farm crops), are not sufficiently heavy and compact, dry out readily, and lack mineral constituents. It is for these first two classes of soils that clover may be used with the greatest benefit, for it is evident, whether sand or clay predominates, a certain proportion of vegetable matter is necessary to make the soil suitable for seed germination and to furnish that warm, moist aerated medium that is essential to luxuriant growth. A poor physical condition of the soil and a lack of sufficient moisture are qualities which follow the loss or absence of humus and they are factors which prevent the crops from utilizing, to the extent they otherwise would, such plant food as a soil may possess.

The Value of Clover as a Fertilizer.

The main object in view in the preparation of this bulletin is to call the attention of Canadian farmers to the very practical and convincing results which have been obtained at the Central Experimental Farm, in increased crops, by the ploughing under of green clover. This practice has been found to increase the crops for several successive seasons. Similar experiments have been tried on the branch experimental farms, with good results, and reports have reached us from many farmers, who have followed with much profit the teaching of the experimental farms in this respect. There seems no reason to doubt that if this method of fertilizing the land were more generally adopted, a considerable increase might be had in the average production of the more important farm crops at very little cost. The experiments conducted at Ottawa have been so planned as to realize the greatest advantages from the clover without interfering with the regularity of the farmers' crops.

These experiments were begun on the Central farm in the spring of 1894, when a field was sown with a variety of two-rowed barley (Canadian Thorpe) and, at the same time, seeded with Mammoth Red clover at the rate of 12 pounds per acre. After the barley was harvested the clover grew rapidly and made a good stand before winter. It was allowed to grow until the following season. By the third week in May, about the time when such a crop should be ploughed under for the planting of Indian corn or potatoes, the clover was quite heavy. On May 25, a box one foot square inside and four feet deep was sunk to its full depth in this crop and by lifting it carefully a fair section of the plants and roots was obtained. On washing away the earth, some of the roots were found to extend down fully four feet, and had thus been able to feed on the stores of fertility existing in the lower depths of the subsoil, beyond the reach of most other crops, and to transfer and utilize these in building up the stalks and leaves. The extensive root system of clover is clearly illustrated on Plate 1. The green leaves and stems in the sample taken were separated from the partly decayed leaves about the base and also from the roots and each weighed and analysed separately. The proportion of nitrogen in pounds per acre found in the different parts of the crop was as follows:—

Green leaves and stems.....	101·3	lbs. per acre.
Semi-decayed material on surface.....	22·5	"
Roots to a depth of four feet.....	48·5	"
Total nitrogen.....	172·3	"

While the ploughing under of a growing crop of clover furnishes the soil, as already stated, with a large amount of organic matter, much of which is subsequently converted into humus, it is evident from the above figures that there is another and still more important part which clover plays in enriching the land, that is, by adding nitrogen. Clover is a plant which belongs to the class of legumes and these have that remarkable property of being able to take a large proportion of the nitrogen they need for their growth from the air. The careful researches of many eminent scientific investigators have shown that the legumes obtain nitrogen from the air found in the interstices between the particles of soil, through the agency of certain micro-organisms present in the soil. These bacteria, whose special function is the assimilation of free nitrogen, attach themselves to the roots of growing clover or other legumes, forming thereon small nodules or tubercles. These nodules, swarming with their countless inhabitants, are to be found in sizes varying from a pin's head to a pea and frequently scattered in large numbers over the roots of the plant. An illustration of clover roots bearing nodules is given in Plate 2. The nitrogen taken in by these microbes and converted into soluble compounds is used by the clover and stored in the tissues of the roots, stems and leaves. The legumes to which clover belongs are especially rich in nitrogen, and though we are unable to say exactly what proportion of this element is taken by them from the air, we may be sure that under favourable conditions the greater part is from that source. These facts, thus briefly put, represent probably the most important discovery in agricultural science of the nineteenth century.

The chief value of ploughing under a crop of clover lies, then, in the addition of humus and its associated mineral plant food and in the addition of nitrogen. By the subsequent decay in the soil of the turned under clover, these constituents are converted into available food for future use for farm crops and fruits. While the growth and harvesting of other crops leaves the soil poorer in nitrogen, the growth of clover, even when the crop has been harvested and the roots only left, leaves the soil invariably richer in this constituent.

INFLUENCE OF CLOVER ON FARM CROPS.

Since 1894, systematic experimental work has been carried on at the Central Experimental Farm with clover to ascertain the practical fertilizing value of this crop. The clover has been sown in the spring with wheat, barley or oats in the proportion of ten pounds of the clover seed to the acre. This has always resulted in a good stand of clover before the close of the season, as it grows rapidly after the grain is harvested. If it is intended to use the land for growing spring grain the following season, the clover is ploughed under about the middle of October; but if the land is to be used for potatoes or Indian corn, the clover is left until the following spring, when, by the second or third week in May, it will have made a heavy growth and will furnish a large amount of material for turning under.

Increase of Crops in 1898 from the Ploughing under of Clover.

In the spring of 1897, eight plots of one-twentieth of an acre each were sown with grain—two of them with spring wheat, four with barley and two with oats. The soil was a sandy loam of fair quality, which had received a dressing of about 15 tons of fresh barn-yard manure in the spring of 1896, which was followed by a crop of roots. These plots were all sown on May 5, two with each sort of grain, one of them in each case with Mammoth Red clover in the proportion of 10 pounds per acre, the other without clover. The wheat was sown at the rate of 1½ bushels; barley (six-rowed) 1¾

bushels; barley (two-rowed) 2 bushels; and oats 2 bushels per acre. The wheat ripened August 9; six-rowed barley, July 26; two-rowed barley, August 2; and the oats, August 9.

The following gives particulars of the crop:—

	Bush.	Lbs.
No. 1—Preston wheat with 10 pounds clover per acre..	16	30
2— " " without clover.....	19	..
3—Odessa barley (six-rowed) with clover.....	42	24
4— " " " without clover.....	37	34
5—Bolton barley, (two-rowed) with clover.....	37	4
6— " " " without clover.....	35	..
7—Banner oats with clover.....	57	32
8— " " without clover.....	61	6

After harvest the plots which had been sown with clover produced a rapid growth of this plant and by October had formed a heavy mat of foliage; the alternate plots on which no clover had been sown were, of course, bare. All these plots were ploughed early in October, about eight inches deep. In the spring of 1898 the land was disc-harrowed and twice harrowed with the smoothing harrow, after which all the plots were sown with one variety of oats, namely, the Banner. The oats were sown on April 27. The difference in the growth of the grain on these plots was soon very noticeable, and, as the season advanced, especially just before the heads appeared, the difference in height and vigour of growth in favour of the plots where the clover had been grown was very remarkable. So clearly was this manifest that it could be distinctly seen at a considerable distance, and the outline of those plots on which clover had not been grown could be readily traced by the decidedly shorter and less vigorous growth. After the grain was fully headed, the difference in appearance was not so clearly noticeable at a distance, but by a careful examination it could be easily traced. When ready to harvest, these plots were cut and threshed separately, and the following results obtained:—

CROP OF BANNER OATS IN 1898.

—	Straw, yield per acre.	Oats, yield per acre.	
	Lbs.	Bush.	Lbs.
Plot 1—On which Preston wheat was sown in 1897 with clover.....	3,770	56	6
Plot 2—After Preston wheat without clover.....	2,160	37	2
An increase in yield after wheat on the plot with clover of.....	1,610	19	4
Plot 3—On which Odessa barley was sown in 1897 with clover	2,180	37	12
Plot 4—After Odessa barley without clover.....	1,450	30	10
An increase in yield after barley on the plot with clover of.....	730	7	2
Plot 5—On which Bolton barley was sown in 1897 with clover.....	3,180	51	26
Plot 6—After Bolton barley without clover.....	2,090	44	24
An increase in yield after barley on the plot with clover of.....	1,090	7	2
Plot 7—On which Banner oats was sown in 1897 with clover.....	5,110	55	
Plot 8—After Banner oats without clover	2,260	44	4
An increase of yield after oats on the plot with clover of.....	2,850	10	30

The lower yields reported on plots 3 and 4 were due to the poorer quality of the soil, which was a light sandy loam. The other plots had a heavier sandy loam of much better quality.

The results of these tests show that the average yield of grain on the four plots with clover exceeded by 11 bushels and 1 pound per acre the yield on those where no clover was used.

Increase of Crops in 1899, the Second Year from the Ploughing under of Clover.

In 1899, the same plots were all sown with one variety of barley, the Mensury, and again we found marked differences in favour of the land sown with clover in 1897. No other fertilizer had been used.

CROP OF MENSURY BARLEY IN 1899—SOWN AFTER BANNER OATS IN 1898

—	Straw, yield per acre.	Barley, yield per acre.	
	Lbs.	Bush.	Lbs.
Plot 1—On which Preston wheat was sown in 1897 with clover	3,120	40	20
Plot 2—After Preston wheat in 1897 without clover.....	1,740	25	20
An increase in yield after oats on the plot with clover of.....	1,380	15	
Plot 3—On which Odessa barley (six-rowed) was sown in 1897 with clover.....	2,620	32	24
Plot 4—After Odessa barley (six-rowed) in 1897 without clover.....	2,440	27	44
An increase in yield after oats on the plot with clover of..	180	4	28
Plot 5—On which Bolton barley (two-rowed) was sown in 1897 with clover.....	2,470	33	26
Plot 6—After Bolton barley (two-rowed) in 1897 without clover.....	2,000	29	28
An increase in yield after oats on the plot with clover of.....	470	3	46
Plot 7—On which Banner oats was sown in 1897 with clover.....	3,270	44	38
Plot 8—After Banner oats in 1897 without clover.....	2,320	33	36
An increase in yield after oats on the plot with clover of.....	950	11	2

Increase in the Yield of Grain and Straw for the First and Second Years.

The average increase in grain after the ploughing under of green clover was: for the first year, when oats were used, 11 bushels 1 pound per acre; and in 1899, when these same plots were sown with barley, the average increase was 8 bushels 31 pounds per acre.

The figures given show that the average yield of straw from the four plots treated with clover was: for the first year, 3,560 pounds per acre, and for the second year, 2,870 pounds; whereas, the weight of straw obtained from the adjoining plots, where clover was not used, was 1,990 pounds per acre in 1898, and 2,125 pounds per acre in 1899. This shows a larger yield of straw where clover was used, of 1,570 pounds per acre the first year, and 745 pounds the second year.

These results are indeed remarkable. They show in the case of the plots under consideration that the ploughing-under of a single crop of clover,

sown with the grain in 1897, produced a wonderful increase both in straw and grain. From the added fertility and humus thus supplied, the crop of straw, when compared with the adjoining plots on which clover had not been sown, was increased 78 per cent in 1898 and 35 per cent in 1899. The increase in the crop of grain was still more remarkable, since it shows a slightly higher percentage for the second year than it did for the first. The increase in the weight of grain on the plots treated with clover, was: in 1898 over 28 per cent; whereas, in 1899 it was over 29 per cent.

Increase in Field Crop of Oats in 1899 from the Ploughing under of Clover.

Early in the spring of 1899 a field of four acres of land was ploughed about 4 inches deep. The soil was a sandy loam of medium quality. On two acres of this land barley had been grown in the spring of 1898, and with it 10 pounds of red clover seed had been sown. After the grain was harvested, the clover made rapid growth, and before winter set in, it had formed a good mat of foliage about a foot high. One acre had been in Brome grass *(Bromus inermis)* in 1898; half an acre had been sown with a mixture of pasture grasses without clover, and another half acre with a mixture of pasture grasses associated with a good proportion of clover.

After ploughing and harrowing, the whole area of four acres was sown with one variety of oats—the Bavarian. Where clover had been ploughed under, its effect was very clearly shown in the growth of the oats, the crop grown after clover being much greener in colour and more vigorous in growth of both leaf and stalk, and when measured about the time the heads of grain were shooting out, the plants on an average were about a foot taller than the oats on the adjoining land, where no clover had been used.

When harvested the results were as follows:—

	Per acre.	
	Bush.	Lbs.
1 acre of oats sown after Brome grass	33	8
½ " " mixture of pasture grasses without clover	36	16
½ acre of oats sown after mixture of pasture grasses with clover	46	4
2 acres of oats sown after barley with clover	43	28

The average of the crop sown where no clover had been used was 34 bushels 29 pounds per acre, while the average of that sown after clover was 44 bushels 33 pounds—a difference of 10 bushels 4 pounds per acre in favour of the crops grown after the ploughing under of clover.

Increase in Yield of Oats in 1900 from Plots after Clover.

In the spring of 1899, six plots of one-fortieth acre each were sown with grain. Two of these plots were sown with Preston wheat; two with Mensury barley; and two with Banner oats. One of these plots in each case had clover sown with the grain at the rate of 12 pounds per acre; the other had no clover. The soil was a sandy loam of fairly good quality, and up to this time the land had been used as a nursery. After the grain crop had been taken off, the clover was allowed to grow until late in the autumn, when it was ploughed under to the depth of 6 or 7 inches. In the spring of 1900, the land was harrowed twice with a disc-harrow and twice with a smoothing harrow, and sown with one kind of oats, viz., New Zealand, at the rate of two bushels of seed per acre. The oats were sown on May 4, 1900, and the crops harvested are shown in the following table:—

PLATE II.

ROOTS OF YOUNG CLOVER PLANTS, SHOWING NODULES.

July 2, 1902.

CROP OF NEW ZEALAND OATS IN 1900.

—	Yield of oats per acre in 1900.	
	Bush.	Lbs.
Plot 1—On which Preston wheat was sown in 1899 with clover.....	53	18
Plot 2—After Preston wheat was sown in 1899 without clover.....	51	26
An increase in yield after wheat on the plot with clover of.....	1	52
Plot 3—On which Mensury barley was sown in 1899 with clover.....	58	28
Plot 4—After Mensury barley was sown in 1899 without clover.....	56	16
An increase in yield after barley on the plot with clover of ...	2	12
Plot 5—On which Banner oats was sown in 1899 with clover.....	58	28
Plot 6—After Banner oats was sown in 1899 without clover.....	56	16
An increase in yield after oats on the plot with clover of	2	12

In this instance the plots sown with clover averaged 57 bushels 2 pounds per acre, while those on which no clover had been sown averaged 54 bushels 31 pounds—a difference in favour of the plots treated with clover of 2 bushels 5 pounds per acre. This increase was the smallest at any time obtained where clover had been ploughed under, and was probably due in part to the fact that the grain with the clover was sown a week later than usual and the subsequent growth of the clover was light and unsatisfactory.

Increase in Yield of Oats in 1901 from Plots after Clover.

In the spring of 1900, another set of six plots was sown with grain—two with Preston wheat, two with Mensury barley and two with Banner oats. One of these plots in each case had common red clover sown with the grain at the rate of 12 pounds per acre; the other had no clover. The soil was a sandy loam of fairly good quality, which had received no manure since 1897, when it had a coating of about 12 tons per acre.

After the grain crop was taken off the clover was allowed to grow until about the middle of October, when it was ploughed under to a depth of 6 or 7 inches. In the spring of 1901, the land was harrowed twice with a disc-harrow and twice with the smoothing harrow, and all the plots were sown on May 4th with Banner oats at the rate of 2 bushels of seed per acre, and harvested August 5th.

CROP OF BANNER OATS IN 1901.

—	Straw, yield per acre.	Yield of oats per acre in 1901.	
	Lbs.	Bush.	Lbs.
Plot 1—On which Preston wheat was sown in 1900 with clover.....	3,440	49	14
Plot 2—After Preston wheat was sown in 1900 without clover.....	2,480	47	2
An increase in yield after wheat on the plot with clover of.	960	2	12
Plot 3—On which Mensury barley was sown in 1900 with clover	2,640	42	12
Plot 4—After Mensury barley was sown in 1900 without clover.....	1,920	37	22
An increase in yield after barley on the plot with clover of.	720	4	24
Plot 5—On which Banner oats was sown in 1900 with clover.... ..	3,040	40	
Plot 6—After Banner oats was sown in 1900 without clover.....	2,240	35	10
An increase in yield after oats on the plot with clover of...	800	4	24

In this instance the plots sown with clover gave an average return of 43 bushels 31 pounds per acre, while those on which clover had not been sown gave 40 bushels—a difference of 3 bushels 31 pounds in favour of the plots with clover. There was also an average increase in the weight of the straw of 827 pounds per acre, being somewhat over 35 per cent.

Taking these twelve trials made with plots of oats during the past four years, the average gain in yield of grain from the use of clover has been about 7 bushels per acre; and in the case of the barley, in which only three trials were made, the average gain was 8 bushels 31 pounds per acre. In the field crop of four acres of oats grown in 1899, the average increase in yield was 10 bushels per acre.

Increase in Crop of Indian Corn in 1898 after Clover.

Favourable results have also been obtained from a series of plots on which Indian corn was planted after clover had been ploughed under. These tests were conducted on plots of one-twentieth of an acre each, which were sown with a crop of two-rowed barley in 1897, when different sorts and quantities of clover were sown with the grain, except plots 7, 10 and 12, which were left as check plots on which barley was sown without clover. The soil was a sandy loam of fair quality, which received a dressing of about 12 tons of barnyard manure per acre in the fall of 1896. In this case the clover was allowed to remain during the winter and to grow until the 23rd of May, 1898, by which time most of the plots had made a heavy growth. The land was then ploughed about 6 or 7 inches deep and harrowed twice with the smoothing harrow before planting.

The variety of corn chosen for this test was Longfellow, which was planted on the 25th of May with the seed drill, in rows 3 feet apart, and was cut on the 15th of September. This corn made a medium and even growth of from 7 to 8 feet, was leafy from top to bottom, and the stalks were well eared, many of the ears then beginning to ripen. The following results were obtained:—

CROPS OF INDIAN CORN (LONGFELLOW) IN 1898.

—	Quantity and Kind of Clover Sown in 1897 with Two-Rowed Barley.	Yield of Fodder Corn per acre in 1898.	
		Tons.	Lbs.
Plot 1..	Mammoth Red clover, 4 lbs. per acre	15	560
" 2..	" 6 "	15	1,720
" 3..	" 8 "	15	1,440
" 4..	" 10 "	15	1,360
" 5..	" 12 "	16	1,920
" 6..	" 14 "	17	1,860
" 7..	Check plot, no clover sown	13	160
" 8..	Common Red, 10 lbs. per acre	22	200
" 9..	Alsike clover, 6 "	15	640
" 10..	Check plot, no clover sown	14	960
" 11..	Alfalfa, 14 lbs. per acre	14	1,320
" 12..	Check plot, no clover sown	13	280
" 13..	Crimson clover, 24 lbs per acre	14	20
" 14..	Alsike, 6 lbs.; orchard grass, 14 lbs. per acre	19	200
" 15..	Alfalfa, 6 lbs.; " " "	14	1,280

These results clearly show the influence of green clover as a fertilizer for Indian corn. The three check plots on which clover had not been sown

gave an average crop of 13 tons 1,133 lbs.; whereas, the other twelve plots, on which different kinds and quantities of clover had been sown, averaged 16 tons 877 lbs.—a difference of 2 tons 1,744 lbs. per acre. It is worthy of note that the plot on which 10 lbs. of common red clover seed had been sown gave 22 tons 200 lbs., while the check plot alongside of it, which had no clover, gave only 13 tons 160 lbs. per acre.

Increase in Crop of Indian Corn in 1900 after Clover.

In the spring of 1899, six plots of one-fortieth of an acre each were sown with grain—two with Preston wheat, two with Mensury barley, and two with Banner oats. One plot in each case had clover sown with the grain at the rate of 12 lbs. per acre; the other had no clover. The soil was a sandy loam of fairly good quality, and up to this time the land had been used as a nursery. After the grain was cut, the land was left untouched until May 24, following, by which time the clover had made a good growth, when it was ploughed under to a depth of 6 or 7 inches. The land was then harrowed twice with a disc-harrow, and twice with a smoothing harrow. The corn was sown with the seed drill on May 25, in rows 3 feet apart, and cut for ensilage on September 13. The variety used for this test was Longfellow.

CROPS OF FODDER CORN (LONGFELLOW) IN 1900.

——	Yield of Fodder Corn per acre in 1900.	
	Tons.	Lbs.
Plot 1—On which Preston wheat was sown in 1899 with clover.....	19	1,560
" 2—After Preston wheat without clover..... ...	16	1,160
An increase in yield after wheat on the plot with clover of.	3	400
" 3—On which Mensury barley was sown in 1899 with clover.....	17	1,120
" 4—After Mensury barley without clover.....	16	1,440
An increase in yield after barley on the plot with clover of.		1,680
" 5—On which banner oats was sown in 1899 with clover.....	18	1,720
" 6—After banner oats without clover.....	14	1,800
An increase in yield after oats on the plot with clover of.	3	1,920

Here we see that the three plots on which the clover had been sown in the proportion of 12 lbs. per acre gave an average weight of 18 tons 1,466 lbs. of fodder corn per acre; while the three on which clover had not been sown averaged 16 tons 133 lbs.—a difference in favour of the plots sown with clover of 2 tons 1,333 lbs. per acre.

Increase in Crop of Indian Corn in 1901 after Clover.

In the spring of 1900, six plots of one-fortieth of an acre each were prepared for this experiment, as described in the test for 1900. The kinds of grain used and the treatment of the land were the same. The alternate plots were sown with 12 lbs. of Common Red clover per acre, which was

ploughed under the following May. The variety of corn used for this test was Selected Leaming, which was sown with the seed drill May 23 and cut for ensilage September 18.

CROPS OF FODDER CORN (SELECTED LEAMING) IN 1901.

—	Yield of Fodder Corn per acre in 1901	
	Tons.	Lbs.
Plot 1—On which Preston wheat was sown in 1900 with clover.....	27	1,760
Plot 2—After Preston wheat was sown without clover.....	19	1,280
An increase in yield after wheat on the plot with clover, of..	8	480
Plot 3—On which Mensury barley was sown in 1900 with clover.....	27	880
Plot 4—After Mensury barley was sown without clover.....	15	1,600
An increase in yield after barley on the plot with clover, of..	11	1,280
Plot 5—On which Banner oats were sown in 1900 with clover.....	25	1,600
Plot 6—After Banner oats were sown without clover.....	20	160
An increase in yield after oats on the plot with clover, of....	5	1,440

In this series of experiments the three plots on which the clover had been sown gave an average weight of 27 tons 80 pounds of fodder corn per acre; while those on which clover had not been sown averaged 18 tons 1,013 pounds—a difference in favour of the plots sown with clover of 8 tons 1,067 pounds per acre, an increase of over 40 per cent. A marked difference could be seen in these plots from an early period in their growth, and, as the crop approached maturity, the increase in height, vigour and leafiness in the corn grown on the plots sown with clover was so striking that it could be clearly seen at a considerable distance.

Taking the results of these 18 experiments made with Indian corn during three years, the average gain in weight of green crop from the use of clover has been 3 tons 1,694 pounds per acre.

Increase in Crop of Potatoes in 1899 after Clover.

In the spring of 1899, a piece of rather light sandy loam of fair quality was planted with potatoes of the variety known as Daisy. Nine rows of these were planted, each 560 feet long, 2½ feet apart, on land on which barley had been grown the previous year. Common Red clover had been sown with the barley in the proportion of 10 pounds of seed per acre. After the grain was cut, the clover made a rapid growth, and had formed a good mat of foliage about 12 inches high by the middle of October, when it was ploughed under about 7 or 8 inches deep. On land adjoining, of the same quality, which had received similar cultivation, 9 rows of the same variety of potatoes were planted on the same day. The previous crop on three-fourths of this latter piece of land had been pease and on the other one-fourth, carrots.

The potatoes were planted on May 25 and were dug October 3.

	Lbs.
Plot 1—On which barley was sown with clover, turned under in October, 1898, the potatoes gave a total yield of	4,208
Plot 2—After pease and carrots, where no clover had been sown, the total yield was	3,025

These results show a difference in favour of the crop where clover was used of about 28 per cent. The foliage of the potatoes grown after clover was much more vigorous and even, and was of a deeper green colour.

Increase in Crop of Potatoes in 1900 After Clover.

In the spring of 1899, six plots of one-fortieth of an acre each were sown with grain—two with Preston wheat, two with Mensury barley, and two Banner oats. One plot in each case had clover sown with the grain, at the rate of 12 lbs. per acre; the other had no clover. The soil was a sandy loam. In the spring of 1900, the clover was ploughed under and the plots were all planted with one variety of potatoes, namely, Rochester Rose. These were planted on May 28, and were dug October 5, with the following results:—

CROPS OF POTATOES (ROCHESTER ROSE) IN 1900.

—	Yield of potatoes per acre.	
	Bush.	Lbs.
Plot 1—On which Preston wheat was sown in 1899 with clover	320	—
Plot 2—After Preston wheat without clover	280	40
An increase in yield after wheat on the plot with clover of	39	20
Plot 3—On which Banner oats was sown in 1899 with clover	301	20
Plot 4—After Banner oats without clover	290	40
An increase in yield after oats on the plot with clover of	10	40
Plot 5—On which Mensury barley was sown in 1899 with clover	330	—
Plot 6—After Mensury barley without clover	280	—
An increase in yield after barley on the plot with clover of	50	—

In these experiments the three plots on which the clover had been sown gave an average of 317 bushels 7 lbs. per acre; while those on which clover had not been sown averaged 283 bushels 47 lbs. per acre—a difference in favour of the plots sown with clover of 33 bushels 20 lbs. per acre.

Increase in Crop of Potatoes in 1901 After Clover.

In the spring of 1900, six plots of one-fortieth of an acre each were prepared for this experiment as described in the test for 1900. The kinds of grain used and the treatment of the land were the same. The alternate plots were sown with 12 lbs. of common red clover per acre, which was ploughed under May 22, 1901. The variety used for this test was the Everett. The potatoes were planted May 23, in rows 2½ feet apart and about one foot apart in the rows, and were dug October 4.

Clover Sown with Ligowo Oats in 1897.

A sample dug October 20 from a field crop of 4½ acres sown on April 30, 1897, with Ligowo oats and 10 lbs. Mammoth Red Clover per acre, produced 8 tons 505 lbs.

Clover Sown with Mensury Barley in 1898.

A similar course of experiments was tried in 1898, when ten plots were sown with Mensury barley on April 27 with clover seeds of different quantities and sorts. They were dug November 5, 1898, and gave the following quantities of clover residues:—

CLOVER SOWN WITH MENSURY BARLEY, 1898.

——	Weight of clover (roots and foliage) per acre.	
	Tons.	Lbs.
Plot 1—Mammoth Red clover, 4 lbs. per acre, produced	5	123
2 " 6 "	5	634
3 " 8 "	5	1,655
4 " 10 "	6	1,262
5 " 12 "	6	761
6 " 14 "	6	1,866
7—Common Red clover, 10 "	5	1,570
8—Alsike clover, 8 "	4	167
9 " 6 "	5	124
10—Alfalfa, 14 "	2	933

These results seem to indicate that 10 or 12 lbs. of clover seed to an acre gives the best results, and that Common Red clover serves the purpose well. The very large increase in the weight of leaves stems and roots when the clover is left over to grow until about May 21 the following year, points to the importance of giving the clover the opportunity of making this extra growth whenever it is intended to plant the land with Indian corn, potatoes or any other crop which can be advantageously sown as late as May 21 to 25.

Value of Winter-Killed Clover.

To obtain information which would be useful to those living in localities where winter killing of clover is common, samples were collected in the spring of 1897 (the winter of 1896–7 having killed practically all the clover on the plots examined), and determinations made as to their manurial value. These clover residues consisted of the shrivelled and browned foliage and stems carefully taken from the surface of a block of soil 4 feet by 4 feet, and the dead roots in the first 9 inches of its depth.

All the clovers were sown at the respective rates mentioned below, on May 5, 1896, with Odessa barley at the rate of 1¾ bushels per acre. The barley on all the plots was cut July 27, 1896. The clover residues were collected May 1, 1897.

CLOVER RESIDUES WITH PROPORTION OF NITROGEN (1897).

—	Weight of clover residues per acre.		Nitrogen per acre.
	Tons.	Lbs.	Lbs.
Plot 1—Mammoth Red clover, 14 lbs. per acre	3	636	59
Plot 2— " " 12 "	3	976	77
Plot 3— " " 10 "	2	1,955	81
Plot 4— " " 8 "	3	976	76
Plot 5— " " 6 "	3	806	70
Plot 6— " " 4 "	2	594	58
Plot 7—Common Red clover, 10 "	3	125	62
Plot 8—Alsike clover, 6 "	1	1,233	33
Plot 9—Alfalfa, 14 "	1	212	26

It is evident from these particulars that notable amounts of nitrogen are present in these residues, and that winter killing of the clover does not form a sufficient excuse for neglecting this economical mode of enriching the soil.

Is the Ploughing under of Clover an Economical Practice?

It is urged by some that the burying of such a large amount of rich food as is contained in a crop of clover is wasteful. This would undoubtedly be true if the farmer had the stock to consume it, for by feeding the clover a part of it would be converted into high-priced animal products, and the manure produced and returned to the soil would give back about 75 per cent of the fertilizing elements contained in the crop. On most farms, however, there is not sufficient stock for such purpose, and in such cases we would strongly advise the growing and ploughing under of clover for recovering, maintaining and increasing the fertility of soils, as we know of no other material of equal fertilizing value that can be so cheaply obtained. We have shown that by sowing 10 or 12 lbs. of Common Red clover seed per acre, costing about $1 to $1.25, there would be a gain of at least 100 lbs. of nitrogen, the lowest price for which in artificial fertilizers is 10 cents per lb. Further, the added store of humus with its associated mineral elements is also of much value. Even when it is found desirable to harvest the crop and sell it off, the land will be considerably enriched, since nearly one-half of the fertilizing constituents of the clover is to be found in the roots.

Clover Compared with Barn-Yard Manure as a Fertilizer.

At the outset it should be understood that in advocating green manuring with clover, this crop is not brought forward as a material to replace barn-yard manure, but rather to supplement it and to make its application more effective. Barn-yard manure of good average quality contains about the following proportions of the chief fertilizing constituents :—

Nitrogen	10	lbs. per ton.
Phosphoric acid	5	"
Potash	9	"

An application of ten tons per acre will, therefore, enrich the soil, approximately by the following amounts :—

Nitrogen	100 lbs.	per acre.
Phosphoric acid	50	"
Potash	90	"

The chemical investigations made in connection with these experiments have shown that a vigorous crop of clover will contain, at a moderate estimate, in its foliage and roots—

Nitrogen	from 100	to 150	lbs.	per acre.
Phosphoric acid	" 30	" 45		"
Potash	" 85	" 115		"

Respecting nitrogen, it is evident that by the use of clover we can with a single crop furnish the soil with as large a quantity as would be supplied by a dressing of 10 tons of manure per acre. The greater part of the nitrogen is gathered by the clover from the air, a source not otherwise available, and is therefore a distinct addition to the soil. The amounts of phosphoric acid, potash and lime in the clover have, it is true, been obtained from the soil, but have been largely drawn from depths beyond the reach of the roots of ordinary crops. The decay of the clover, moreover, liberates these important fertilizing elements in soluble and available forms, so that they can be readily utilized by the crops which follow.

Fertilizers for Clover.

Clover requires, for strong and healthy growth, considerable quantities of phosphoric acid, potash and lime. If the soil is well supplied with these, the clover plant, once established, can obtain with the aid of the germs in the nodules on its roots all the nitrogen needed for strong growth. Where the soil is poor in these mineral constituents, they may be supplied by using a dressing of wood ashes and superphosphate of lime. The unleached ashes of hard woods are a most valuable fertilizer. They contain on an average 5 to 6 per cent of potash, 2 to 3 per cent of phosphoric acid, and about 30 per cent of lime. A dressing of 50 to 100 bushels per acre would be sufficient. Where wood ashes cannot be had, one of the German potash salts now found in the fertilizer market may be used in its place. One of these, muriate of potash, contains about 50 per cent of actual potash and may be used in the proportion of 100 pounds per acre. Kainite, which is one of the lower grades of these salts and contains about 12 per cent of potash, should be applied to the extent of about 400 pounds per acre.

Superphosphate of lime will be found a convenient form in which to apply phosphoric acid and lime. Good brands will usually contain about 15 per cent of phosphoric acid in an immediately available form. From 250 to 300 pounds per acre would be a suitable dressing. Thomas' phosphate is also a useful source of phosphoric acid, especially for sour soils and such as are deficient in lime. It contains from 12½ to 17 per cent of phosphoric acid present in a form which, though not immediately soluble, gradually becomes available for plant use.

On peaty or mucky soils, lime is often the only addition needed to secure good crops of clover. From 20 to 40 bushels per acre will usually be sufficient. Marl may be used as a source for lime where it is cheaply obtainable, but should be applied in somewhat larger quantities.

Where a soil is particularly poor in quality, a dressing of barn-yard manure will be found of great advantage in starting the clover. This will not

only furnish a supply of food immediately available for the crop, but will aid in keeping the soil in a moist condition, which is important in clover growing. Heavy clay soils require underdraining before they will give their best returns with clover. A moist, mellow, well aerated soil, which is most suitable for successful clover growing, cannot often be had on stiff clay land which has not been drained.

Summary.

The advantages connected with the ploughing under of clover may be summed up as follows:—

1. There is an enrichment of the soil by the addition of nitrogen obtained from the atmosphere.

2. There is an increase to the store of available mineral plant food (phosphoric acid, potash and lime) in the surface soil taken by the clover in part from depths not reached by the shallower root systems of other farm crops.

3. There is a large addition of humus, whereby the soil is made more retentive of moisture, warmer and better aerated, conditions favourable to vigorous crop growth. Humus also furnishes the material best adapted for the development of those forms of germ life that act so beneficially in the soil.

4. As an agent for deepening and mellowing soils, no crop gives such satisfactory results as clover.

5. Clover also serves a useful purpose as a catch crop during the autumn months, when the ground would be otherwise bare, retaining fertilizing material brought down by the rain, and also that formed in the soil during the summer months, much of which would otherwise be lost through the leaching action of rains.

6. As shown conclusively by the particulars we have submitted, obtained by careful experiment over a number of years with the more important farm crops, the ploughing under of green clover has a most marked effect in increasing the soil's productiveness.

133
.E22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

RESULTS OBTAINED IN 1902

FROM

TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS

AND

POTATOES

BY

WILLIAM SAUNDERS, LL.D.,

Director of Experimental Farms

BULLETIN No. 41

DECEMBER, 1902

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER,
MINISTER OF AGRICULTURE

TABLE OF CONTENTS

	Page.
Results of trial plots for 1902	7
Varieties of oats	8
" barley	11
" spring wheat	15
" pease	18
" Indian corn	21
" turnips	24
" mangels	27
" carrots	30
" sugar beets	33
" potatoes	36
Average crops for a series of years	40
Three to eight years' experience with varieties of oats	40
" " " barley	42
" " " spring wheat	45
" " " pease	46
" " " Indian corn	48
" " " turnips	50
Three to seven years' experience with varieties of mangels	52
" " " carrots	54
Four to six years' experience with varieties of sugar beets	56
Three to eight years' experience with varieties of potatoes	58
Conclusions	61

To the Honourable

The Minister of Agriculture.

SIR,—I herewith submit for your approval Bulletin No. 41 of the Experimental Farm series, which has been prepared by myself. There are presented in this publication the results of a large number of experiments, which have been conducted at all the experimental farms in your Department during the season of 1902, with oats, barley, spring wheat, pease, Indian corn, turnips, mangels, carrots, sugar beets and potatoes in plots of uniform size, and the crops grown under uniform conditions. The average results also are given of three to eight years' tests on such plots with varieties of oats, barley, spring wheat, pease, Indian corn, turnips and potatoes, three to seven years with plots of mangels and carrots, and four to six years' experience with sugar beets.

These trial plots are conducted with the object of gaining information as to the relative productiveness of the different sorts and their earliness in ripening. The returns show much variation in the weight of the crops grown and point to the importance of care in the choice of varieties of seed for sowing. It is hoped that these results giving the experience gained under some of the most important climatic variations found in the country, will prove useful to farmers in every part of Canada.

I have the honour to be,

Your obedient servant,

WM. SAUNDERS,

Director of Experimental Farms

OTTAWA, December 8, 1902.

RESULTS OBTAINED IN 1902

FROM TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS AND POTATOES

By William Saunders, LL.D., F.R.S.C., F.L.S., F.C.S., &c.

Director of Experimental Farms.

During the past eight years experiments have been conducted on uniform trial plots at each of the Dominion Experimental Farms for the purpose of gaining information as to the most productive and earliest ripening varieties of grain, fodder corn, field roots and potatoes. In arranging for these plots the same varieties have been sown at each of the farms, the seed being supplied at the outset from a common stock. In each case the seed has been sown early, and, as a rule, all the different sorts of the same product have been sown on the same day or at most within two or three days so as to give to all an even start. The land chosen each year for these plots has been as nearly uniform in character as could be found and before sowing has been brought into a good condition of tilth. In this bulletin which is the eighth of the series, the details are arranged after the same plan as in the previous issues, the different varieties being placed in the tables which follow in the order of their productiveness at the Central Experimental Farm. The number of days required for each sort from sowing to ripening is also given and thus their relative earliness is shown.

In comparing the crops obtained from the several varieties in any one year with another, the relative positions occupied by the different sorts will often vary from lack of uniformity in the soil, and other causes. When, however, the average of such results can be given for a number of years the information becomes much more satisfactory and valuable.

In the experience recorded near the end of this bulletin the average crops obtained from the sowings of a number of successive years are shown, all those which have been three years under trial being placed in competition with those which have been tested for longer periods.

A break in the records of these tests has been necessary at Brandon this year owing to a very heavy rain storm or 'cloud burst' in June. This storm washed away many of the varieties of pease and barley, and others were so much injured by flooding that any comparisons of yield of varieties would be valueless. Under the circumstances the injured sorts have been omitted from this bulletin, but the particulars of their yields will be found in the annual report of the Experimental Farms for 1902.

By comparing the crops of the past year with the average of previous years it will be seen that the results of the harvest of 1902 have on the whole been very satisfactory.

TRIAL PLOTS OF OATS.

During the season of 1902, sixty-five varieties have been under trial. The size of the plots on which they were sown at the Experimental Farms in Ottawa, Ont., Nappan, N.S., and Agassiz, B.C., was one-fortieth of an acre each, and at Brandon, Man., and Indian Head, N.W.T., they were one-twentieth of an acre each. The quantity of seed sown was in the proportion of two bushels per acre, and the dates of sowing were as follows :—At Ottawa, April 18, Nappan, April 30, Brandon, May 27-28, Indian Head, May 12, and at Agassiz, April 21.

Particulars as to the character of the land in each case, and of the preparation and treatment it has had will be found in the annual report of the Experimental Farms for 1902.

In Canada the bushel of oats is 34 lbs.

UNIFORM TEST PLOTS OF OATS.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms Season of 1902.												Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.		Nappan, N. S.		Brandon, Man.		Indian Head, N. W. T.		Agassiz, B. C.		Average of all Farms.		Ottawa, Ont.	Nappan, N. S.	Brandon, Man.	Indian Head, N. W. T.	Agassiz, B. C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	Improved American	90	20	82	12	64	4	82	20	54	14	74	28	118	122	100	106	113	112
2	Sensation	83	18	100	..	70	..	63	18	55	10	74	16	116	120	99	109	112	111
3	White Russian	83	18	89	14	45	..	68	28	58	18	69	2	117	118	100	105	113	111
4	Siberian	82	12	102	12	82	2	77	2	64	4	81	20	118	124	103	112	116	114
5	Banner	81	6	90	20	70	20	88	8	70	30	80	17	114	116	102	107	114	111
6	Columbus	81	6	97	22	66	6	80	20	72	32	79	24	116	126	103	108	113	113
7	Flying Scotchman	80	..	88	8	47	2	57	2	59	14	66	12	117	116	100	104	110	109
8	Salzer's Big Four	78	28	97	22	43	28	72	2	47	12	67	32	118	120	102	110	114	113
9	New Zealand	77	22	103	18	62	2	75	10	64	24	76	22	123	131	103	112	123	118
10	White Giant	77	22	104	24	50	..	55	10	61	16	69	28	117	123	101	104	113	112
11	Holstein Prolific	77	22	97	22	81	6	82	2	61	16	80	..	117	123	102	106	112	112
12	Early Golden Prolific	77	22	102	12	82	28	65	10	60	10	77	23	117	125	101	106	115	113
13	Golden Beauty	76	16	91	26	56	16	75	10	67	6	73	15	113	124	101	105	115	112
14	Newmarket	76	16	100	.	61	6	65	30	60	30	72	30	111	118	99	105	116	110
15	Hazlett's Seizure	75	10	83	18	73	28	64	4	74	4	74	6	118	118	99	104	114	111
16	Buckbee's Illinois	75	10	92	32	82	12	68	28	63	18	76	20	116	120	103	104	114	111
17	Danish Island	75	10	97	22	67	2	89	14	71	16	80	6	116	124	103	105	113	112

UNIFORM TEST PLOTS OF OATS—*Continued.*

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms Season of 1902.												Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
18	Twentieth Century	72	32	91	26		*		†	61	26	72	12	117	118	*	†	112	115
19	Mennonite	72	32	102	12	77	2	65	10	62	12	76	..	118	123	100	106	110	111
20	Waverley	71	26	70	20	60	13	75	10	75	30	70	27	116	120	101	110	115	112
21	White Schonen	70	20	105	30	53	8	62	12	66	20	71	25	117	118	102	104	112	111
22	Joanette	70	20	87	2	74	24	66	16	64	24	72	24	115	120	105	112	120	114
23	Brandon	70	20	74	4	60	20	60	..	62	32	65	22	118	123	103	108	113	113
24	Cream Egyptian	70	20	84	24	61	26	42	12	68	28	65	22	116	118	99	105	115	111
25	American Beauty	69	14	102	12	61	6	68	8	62	22	72	26	111	125	100	106	116	112
26	Irish Victor	69	14	83	18	60	30	74	24		†	72	4	117	120	103	112	†	113
27	Wide Awake	68	8	85	30	64	24	80	20	48	8	69	18	116	122	102	105	113	112
28	Early Gothland	68	8	82	12	64	24	56	16	71	6	68	20	116	118	102	112	115	112
29	American Triumph	68	8	93	28	70	30	57	22	55	..	69	4	117	128	103	110	115	114
30	Abundance	67	2	89	14	72	2	80	20	60	10	73	30	117	117	101	105	115	111
31	Improved Ligowo	67	2	97	22	51	6	72	24	65	30	70	30	114	120	101	106	113	111
32	Goldfinder	65	30	100	..	53	28	74	4	65	10	71	28	118	124	102	110	115	114
33	Lincoln	65	30	102	12	65	10	66	16	69	14	73	30	117	125	102	105	112	112
34	Bavarian	64	24	100	..	61	6	74	24	56	16	71	14	117	120	102	105	115	112
35	Black Beauty	64	24	87	2	60	..	66	16	72	22	70	6	117	113	105	108	109	110
36	Kendal	64	24	80	..	56	6	64	24	66	10	66	13	117	122	102	112	112	113
37	Salines	64	24	107	2	47	12	74	24	55	10	69	28	123	118	103	112	110	113
38	Holland	64	24	82	12	57	32	49	14	72	2	65	10	123	124	108	108	113	115
39	Pense	63	18	85	30	55	10	62	32	50	6	63	19	113	120	106	117	112	113
40	Prolific Blk. Tartarian	63	18	95	10	51	6	63	18	63	28	67	16	117	123	108	114	112	115
41	Wallis	63	18	93	28	74	24	71	26	54	14	71	22	111	122	101	110	114	112
42	Early Maine	62	12	101	6	74	24	54	4	70	..	72	96	117	123	101	106	112	112
43	Olive	62	12	85	30	45	20	62	32	57	22	62	30	117	120	107	113	113	114
44	Master	62	12	75	10	53	8	61	26	72	12	65	..	118	122	102	110	114	113
45	Russell	62	12	88	8	54	24	54	24	52	2	62	14	113	122	104	106	112	111
46	Thousand Dollar	61	6	95	10	63	8	78	24	59	14	71	19	117	120	103	106	113	112
47	Golden Tartarian	61	6	111	26	59	24	83	18	73	18	77	32	123	131	110	112	116	118
48	Golden Giant	61	6	108	8	70	..	82	32	77	22	80	..	122	128	106	112	114	116
49	Bonanza	60	..	87	2	67	32	49	14	65	..	65	30	111	123	97	104	113	109
50	Milford	60	..	83	18	50	20	67	22	61	6	64	20	117	120	110	110	113	114
51	Early Blossom	60	..	96	16	53	18	59	18	62	12	66	13	119	120	103	112	113	113
52	Oderbruch	58	28	91	26	55	23	75	10	58	18	68	1	118	120	101	106	115	112
53	Black Mesdag	58	28	82	12	53	18	57	22	58	28	62	8	106	108	101	112	109	107
54	Tartar King	56	16	97	22	63	8	86	16	72	32	75	12	114	119	102	106	110	110
55	Abyssinia	56	16	101	6	47	32	66	16	61	26	66	24	117	121	100	106	113	111
56	California Prolific Blk	56	16	85	30	56	16	63	18	66	10	65	25	118	122	105	116	113	115
57	Oxford	56	16	87	2	59	14	78	8	69	14	70	4	117	122	103	106	110	112
58	King	56	16	82	12	54	14	74	24	57	32	65	6	117	125	102	108	113	113
59	Rosedale	55	10	88	8	42	22	66	16	65	..	63	18	117	118	102	112	114	112
60	Early Archangel	54	4	71	26	62	32	71	26	62	12	64	20	118	118	102	104	113	111
61	Cromwell	54	4	105	30	‡		56	16	59	4	68	30	118	124	‡	112	115	117
62	Pioneer	54	4	95	10	43	8	46	20	70	20	61	33	114	118	105	113	110	112
63	Miller	54	4	90	20	47	32	71	26	59	4	64	24	117	126	100	108	112	112
64	Scotch Potato	36	16	85	30	61	6	56	16	60	30	60	6	121	122	102	110	115	114
65	Longhoughton	31	26	72	32	36	16	54	4	56	16	50	12	120	123	102	110	115	114

*Destroyed by flood.

†Not sown.

‡Nearly destroyed by wash of heavy rainstorm.

The twelve varieties of oats which have produced the largest crops during 1902, at the several Experimental Farms, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Improved American	90	20	7. Flying Scotchman	80	..
2. Sensation	83	18	8. Salzer's Big Four	78	28
3. White Russian	83	18	9. New Zealand	77	22
4. Siberian	82	12	10. White Giant	77	22
5. Banner	81	6	11. Holstein Prolific	77	22
6. Columbus	81	6	12. Early Golden Prolific	77	22

An average crop of 80 bushels 33 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Golden Tartarian	111	26	7. New Zealand	103	18
2. Golden Giant	108	8	8. American Beauty	102	12
3. Salines	107	2	9. Siberian	102	12
4. Cromwell	105	30	10. Lincoln	102	12
5. White Schonen	105	30	11. Early Golden Prolific	102	12
6. White Giant	104	24	12. Mennonite	102	12

An average crop of 104 bushels 31 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Early Golden Prolific	82	28	7. Wallis	74	24
2. Buckbee's Illinois	82	12	8. Early Maine	74	24
3. Siberian	82	2	9. Hazlett's Seizure	73	28
4. Holstein Prolific	81	6	10. Abundance	72	2
5. Mennonite	77	2	11. American Triumph	70	30
6. Joanette	74	24	12. Banner	70	30

An average crop of 76 bushels 22 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Danish Island	89	14	7. Holstein Prolific	82	2
2. Banner	88	8	8. Abundance	80	20
3. Tartar King	86	16	9. Columbus	80	20
4. Golden Tartarian	83	18	10. Wide Awake	80	20
5. Golden Giant	82	32	11. Thousand Dollar	78	24
6. Improved American	82	20	12. Oxford	78	8

An average crop of 82 bushels 28 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Golden Giant	77	22	7. Black Beauty	72	22
2. Waverley	75	30	8. Master	72	12
3. Hazlett's Seizure	74	4	9. Holland	72	2
4. Golden Tartarian	73	18	10. Danish Island	71	16
5. Tartar King	72	32	11. Early Gothland	71	6
6. Columbus	72	32	12. Banner	70	30

An average crop of 73 bushels 4 lbs. per acre.

The twelve varieties of oats which have produced the largest crops in 1902, taking the average results obtained on all the Experimental Farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Siberian..	81	20	7. Golden Tartarian	77	23
2. Banner..	80	17	8. Early Golden Prolific..	77	23
3. Danish Island..	80	6	9. New Zealand..	76	22
4. Holstein Prolific..	80	..	10. Buckbee's Illinois..	76	20
5. Golden Giant..	80	..	11. Mennonite..	76	..
6. Columbus..	79	24	12. Tartar King..	75	12

An average crop of 78 bushels 17 lbs. per acre.

The average crop of all the varieties of oats tested at each of the Experimental Farms in 1902, was as follows :—At Ottawa, 65 bushels 19 lbs. per acre ; Nappan, 90 bushels 18 lbs. ; Brandon, 60 bushels 11 lbs. ; Indian Head, 67 bushels 30 lbs., and at Agassiz, 63 bushels 10 lbs. The average return given by the whole of the varieties of oats tested at all the farms was 70 bushels 4 lbs. per acre.

TRIAL PLOTS OF BARLEY.

During the season of 1902, fifty-one varieties of barley have been under test. twenty-one of which were two-rowed sorts and thirty six-rowed. The barley plots were of the same size as those sown with oats, the seed was used in the proportion of two bushels per acre, and the dates of sowing were as follows :—At Ottawa, Ont., April 17 ; Nappan, N.S., May 16 ; Indian Head, N.W.T., May 17, and at Agassiz, B.C., April 19.

In Canada the bushel of barley is 48 lbs.

UNIFORM TEST PLOTS OF TWO-ROWED BARLEY.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms, Season of 1902.										Number of Days from Sowing to Harvesting				
		Ottawa, Ont.		Nappan, N.S.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.
1	French Chevalier	68	16	49	8	43	16	33	16	48	26	109	105	110	117	110
2	Danish Chevalier.	64	8	60	40	53	36	37	24	54	3	109	105	110	116	110
3	Canadian Thorpe.....	62	24	50	40	49	8	46	32	52	14	109	102	103	112	107
4	Kinver Chevalier	60	..	44	8	51	32	48	16	51	2	108	105	110	117	110
5	Gordon	55	40	40	40	45	40	38	6	45	8	109	102	98	111	110
6	Fulton....	55	..	37	24	42	44	30	..	41	17	108	103	102	112	106
7	Logan	54	8	42	24	42	24	25	10	41	5	109	103	101	112	106
8	Bolton.....	53	16	37	24	45	40	29	28	41	27	105	103	101	109	105
9	Dunham.....	53	16	40	..	42	4	52	44	47	4	109	102	99	116	107
10	Beaver.....	52	24	43	16	51	32	33	6	45	8	105	103	110	114	108
11	Newton...	50	40	50	..	47	24	40	20	47	9	111	103	110	112	109
12	Standwell.....	50	..	47	24	55	24	37	44	47	35	110	106	110	115	110
13	Victor.....	48	16	47	24	43	36	31	4	42	32	105	103	101	112	105
14	Harvey.....	48	16	45	..	48	36	40	30	45	33	109	102	102	111	106
15	Sidney.....	46	32	45	40	59	4	39	8	47	33	108	102	99	116	106
16	Prize Prolific	46	32	38	16	47	24	43	16	43	46	112	103	110	112	109
17	Nepean.....	46	32	43	16	37	44	36	32	41	7	105	102	103	115	106
18	Clifford...	46	32	44	8	55	..	36	2	45	23	105	103	102	111	105
19	Invincible.....	45	40	39	8	57	44	48	26	47	42	111	103	107	111	108
20	Jarvis	45	..	40	.	52	24	33	36	42	39	107	103	101	111	106
21	Leslie.....	39	8	33	16	48	36	35	20	39	8	109	102	98	116	106

The six varieties of two-rowed barley which have given the largest crops during 1902, at the several Experimental Farms, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. French Chevalier..	63	16	4. Kinver Chevalier..	60	..
2. Danish Chevalier	64	8	5. Gordon..	55	40
3. Canadian Thorpe..	62	24	6. Fulton..	55	..

An average crop of 60 bushels 47 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Danish Chevalier..	60	40	4. French Chevalier	49	8
2. Canadian Thorpe..	50	40	5. Victor..	47	24
3. Newton..	50	..	6. Standwell	47	24

An average crop of 50 bushels 47 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Sidney..	59	4	4. Clifford..	55	..
2. Invincible..	57	44	5. Danish Chevalier	53	36
3. Standwell..	55	24	6. Jarvis..	52	24

An average crop of 55 bushels 30 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Dunham..	52	44	4. Canadian Thorpe..	46	32
2. Invincible..	48	26	5. Prize Prolific..	43	16
3. Kinver Chevalier..	48	16	6. Harvey....	40	30

An average crop of 46 bushels 35 lbs. per acre.

The six varieties of two-rowed barley which have produced the largest crops in 1902, taking the average results on all the Experimental Farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Danish Chevalier	54	3	4. French Chevalier	48	26
2. Canadian Thorpe	52	14	5. Invincible	47	42
3. Kinver Chevalier	51	2	6. Standwell	47	35

An average crop of 50 bushels 12 lbs. per acre.

The average crop of all the varieties of two-rowed barley tested at each of the Experimental Farms in 1902, was as follows :—At Ottawa, 52 bushels 3 lbs. per acre ; Nappan, 43 bushels 41 lbs. ; Indian Head, 48 bushels 34 lbs., and at Agassiz, 37 bushels 47 lbs. The average return given by the whole of the varieties of two-rowed barley tested at all the farms was 45 bushels 31 lbs. per acre.

UNIFORM TEST PLOTS OF SIX-ROWED BARLEY.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms Season of 1902.										Number of Days from Sowing to Harvesting.				
		Ottawa, Ont.		Nappan, N.S.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.
1	Blue Long Head	74	8	40	..	62	24	32	44	52	19	108	103	101	111	106
2	Yale	73	16	52	24	48	16	40	10	53	29	105	101	99	108	103
3	Trooper	65	40	54	8	48	16	36	22	51	9	103	99	99	112	103
4	Stella	65	40	58	16	48	36	37	4	52	24	105	104	101	112	105
5	Odessa	65	..	51	32	65	..	38	16	55	..	104	98	99	107	102
6	Mensury	64	8	50	..	51	12	38	36	51	2	105	103	99	109	104
7	Hulless Black	63	16	48	16	47	24	36	32	48	46	104	96	107	109	104
8	Surprise	63	16	53	16	53	36	50	40	55	15	104	104	101	109	104
9	Brome	60	40	50	..	49	28	37	34	52	1	107	103	101	111	105
10	Nugent	60	40	52	24	53	36	40	..	51	37	106	104	110	111	108
11	Pioneer	60	..	44	8	44	8	39	38	47	1	107	101	102	107	104
12	Hulless White	57	24	44	8	35	..	39	8	43	46	100	96	107	112	104
13	Garfield	55	..	58	16	52	4	37	44	50	40	104	98	99	109	102
14	Petschora	53	16	42	24	42	8	35	10	43	14	106	99	99	107	103
15	Oderbruch	52	24	52	24	49	8	50	40	51	12	104	98	99	107	102
16	Argyle	51	32	52	24	45	20	34	8	45	45	109	98	99	109	104
17	Success	50	40	49	8	37	24	34	18	42	47	101	96	99	105	100
18	Common	50	40	63	16	50	.	30	20	48	31	104	98	101	107	102
19	Vanguard	50	40	50	..	40	20	39	18	45	8	103	99	99	109	102
20	Rennie's Improved	49	8	51	32	46	32	52	24	50	..	104	99	99	107	102
21	Excelsior	48	16	51	32	38	16	35	..	43	16	101	96	99	105	100
22	Royal	47	24	59	8	58	36	39	28	51	12	103	99	99	107	102
23	Albert	47	24	47	24	42	4	37	24	43	31	104	98	99	107	102
24	Summit	47	24	43	16	60	40	55	..	51	32	103	104	103	109	105
25	Mansfield	46	32	56	32	57	44	38	46	50	2	109	101	99	109	104
26	Empire	46	32	55	..	63	44	32	34	49	15	106	103	101	109	105
27	Champion	45	40	45	40	36	32	38	6	41	29	101	96	99	105	100
28	Claude	37	24	49	8	66	32	39	8	48	6	105	103	101	109	104
29	Phœnix	36	32	39	8	40	..	35	40	37	44	103	101	99	107	102
30	Baxter	35	..	53	16	40	20	35	30	41	4	103	98	99	107	102

The six varieties of six-rowed barley which have given the largest crops during 1902, at the several Experimental Farms, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Blue Long Head..	74	8	4. Stella..	65	40
2. Yale..	73	16	5. Odessa..	65	..
3. Trooper..	65	40	6. Mensury..	64	8

An average crop of 68 bushels 3 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Common..	63	16	4. Stella..	58	16
2. Royal..	59	8	5. Mansfield..	56	32
3. Garfield..	58	16	6. Empire..	55	..

An average crop of 58 bushels 23 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Claude..	66	32	4. Blue Long-head....	62	24
2. Odessa..	65	..	5. Summit..	60	40
3. Empire..	62	44	6. Royal..	58	36

An average crop of 62 bushels 37 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Summit..	55	..	4. Surprise..	50	40
2. Rennie's Improved..	52	24	5. Yale..	40	10
3. Oderbruch....	50	40	6. Nugent..	40	..

An average crop of 48 bushels 11 lbs. per acre.

The six varieties of six-rowed barley which have produced the largest crops in 1902, taking the average results obtained on all the Experimental Farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Surprise..	55	15	4. Stella..	52	24
2. Odessa..	55	..	5. Blue Long Head..	52	19
3. Yale..	53	29	6. Brome..	52	1

An average crop of 53 bushels 23 lbs. per acre.

The average crop of all the varieties of six-rowed barley tested at each of the Experimental Farms in 1902, was as follows :—At Ottawa, 54 bushels 12 lbs. per acre; Nappan, 50 bushels 32 lbs. ; Indian Head, 49 bushels 9 lbs., and at Agassiz, 39 bushels. The average return given by the whole of the varieties of six-rowed barley tested at all the farms was 48 bushels 17 lbs. per acre.

TRIAL PLOTS OF SPRING WHEAT.

Seventy-one varieties of spring wheat were grown on the uniform trial plots during 1902. The size of the plots was one-fortieth of an acre each at Ottawa, Ont., Nappan, N.S., and Agassiz, B.C., and one-twentieth of an acre each at Brandon, Man., and Indian Head, N.W.T., and the quantity of seed sown was in the proportion of one and one-half bushels per acre. The dates of sowing were as follows :—At Ottawa, April 15, Nappan, April 26, Brandon, May 5 and 6, Indian Head, May 27, and at Agassiz, April 18.

The crops given by the different varieties have been very large at Ottawa, and extraordinary at Nappan and Agassiz. They have also been very good at the Indian Head and Brandon farms.

In Canada the bushel of wheat is 60 lbs.

UNIFORM TEST PLOTS OF SPRING WHEAT.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms, Season of 1902.												Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	Pringle's Champlain	46	..	40	..	24	20	42	20	38	..	38	8	115	127	113	131	124	122
2	Rio Grande	44	..	52	20	29	50	49	..	59	15	46	53	120	128	114	132	123	123
3	Preston	43	20	47	20	25	..	48	40	46	45	42	13	115	127	113	128	115	119
4	Huron	42	40	50	20	25	40	40	..	35	30	38	50	122	127	114	125	116	121
5	Red Fern	42	40	48	40	32	..	48	..	37	45	41	49	122	128	112	132	122	123
6	Roumanian	42	40	48	40	36	20	47	..	41	30	45	14	124	128	117	131	124	125
7	White Russian	42	..	44	..	33	20	32	40	44	..	39	12	123	131	122	130	123	126
8	Herisson Bearded	42	..	39	20	34	..	44	..	43	45	40	37	123	131	113	132	120	124
9	Admiral	42	..	37	20	33	50	41	20	47	30	40	24	122	128	119	128	123	124
10	Blenheim	42	..	42	40	30	20	31	..	46	..	38	24	121	128	114	130	120	122
11	Hungarian	40	40	52	..	23	50	40	..	40	..	39	18	121	128	115	131	122	123
12	Dawn	40	40	37	20	34	20	35	..	50	..	39	28	115	128	117	127	115	120
13	Crown	40	40	51	20	33	40	34	40	44	15	40	55	118	128	113	130	116	121
14	Crawford	40	40	46	40	27	..	26	..	37	30	35	34	115	128	116	128	115	120

UNIFORM TEST PLOTS OF SPRING WHEAT—*Concluded.*

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms, Season of 1902.												Number of Days from Sowing to Harvesting.					
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
15	Laurel	40	40	43	20	32	40	27	40	45	30	37	58	120	131	122	132	120	125
16	Bishop	40	40	40	40	25	40	30	40	39	15	35	23	115	127	112	129	115	120
17	Percy	40	..	43	20	29	20	44	..	39	45	39	17	115	127	112	129	120	121
18	Countess	40	..	45	20	37	20	29	..	36	15	37	35	118	128	121	130	122	124
19	Monarch	39	20	42	..	34	40	35	40	45	30	39	26	123	131	119	131	119	125
20	Plumper	39	20	54	..	24	20	44	40	47	15	41	55	120	128	112	128	123	122
21	Ebert	39	20	40	40	24	40	30	40	34	30	33	58	110	128	106	128	115	117
22	Red Fife	38	40	48	40	31	..	29	20	48	15	39	11	121	128	120	130	123	124
23	White Fife	38	40	46	..	35	20	34	40	45	15	39	59	122	131	121	130	122	125
24	Dion's	38	40	40	..	31	..	44	..	36	30	38	2	121	128	115	131	120	123
25	Vernon	38	40	54	40		*	41	..	39	..	43	20	123	128	....	131	116	129
26	White Chaff Campbell's	38	..	43	20	37	40	38	20	51	..	41	40	121	131	121	130	120	124
27	Benton	38	..	50	..	34	..	25	40	44	30	38	26	122	127	114	130	124	123
28	Byron	38	..	46	40	24	40	37	40	38	45	37	9	122	128	113	129	116	121
29	Clyde	38	..	47	20	35	10	29	40	49	..	39	50	124	128	121	129	122	125
30	Essex	38	..	38	..	27	50	29	..	45	45	35	43	125	128	115	132	124	125
31	Minnesota, No. 149	38	..	38	40	32	..	37	20	50	30	39	18	123	131	119	133	124	126
32	Australian, No. 19	38	..	38	..	27	40	32	40	41	15	35	31	123	131	120	130	122	125
33	White Connell	37	20	40	..	32	..	34	..	39	30	36	34	122	131	119	131	119	124
34	Japanese	37	20	55	20	22	..	26	20	30	..	34	12	119	128	106	128	115	119
35	Robin's Rust Proof	37	20	42	..	32	20	28	20	37	15	35	27	122	131	119	131	124	125
36	Minnesota, No. 181	37	20	36	40	*		32	40	56	30	40	47	122	131	*	133	123	127
37	Australian, No. 13	37	20	46	40	30	40	31	20	33	..	35	48	124	131	114	130	122	124
38	Colorado	36	40	49	20	30	20	45	40	57	30	43	54	118	127	113	132	119	122
39	Hastings	36	40	41	20	30	20	27	20	40	15	35	11	114	128	113	129	115	119
40	Rideau	36	40	37	20	31	10	33	..	41	45	35	59	113	128	120	130	122	122
41	Advance	36	40	49	20	*		30	40	44	45	40	21	121	128	*	131	115	124
42	Progress	36	40	41	20	29	10	38	20	52	..	39	30	122	131	119	128	119	124
43	Minnesota, No. 169	36	40	35	20	30	50	33	..	38	30	34	52	122	131	119	133	122	125
44	Minnesota, No. 163	36	40	38	..	29	40	35	40	42	30	36	30	123	131	117	133	122	125
45	Mason	36	..	42	40	32	30	37	..	38	15	37	17	120	128	117	129	124	123
46	Beaudry	35	20	50	..	27	20	35	..	46	15	38	47	118	128	113	131	120	122
47	Fraser	35	20	35	20	23	20	35	..	41	15	34	3	108	131	111	128	115	119
48	Norval	35	20	55	20	28	20	34	..	31	..	36	48	114	128	111	129	115	119
49	Wellman's Fife	34	40	46	40	30	..	39	20	35	..	37	8	122	131	115	130	119	123
50	Harold	34	40	38	..	23	40	27	20	36	45	32	5	110	127	106	128	113	117
51	Blair	34	40	35	20	30	..	33	40	43	..	35	20	115	129	113	129	120	121
52	Red Swedish	34	..	40	..	28	40	39	..	48	45	38	5	119	131	117	131	124	124
53	Captor	34	..	47	20	32	30	29	..	49	30	38	28	118	128	119	130	115	122
54	Ladoga	33	20	42	..	26	40	38	20	57	..	39	28	118	124	109	128	115	119
55	Beauty	33	20	42	..	24	20	30	40	37	45	33	37	122	128	118	130	123	124
56	Alpha	32	40	48	40	29	40	36	..	35	15	36	27	123	128	120	129	119	124
57	Weldon	32	40	40	..	25	..	42	..	32	..	34	20	122	131	121	129	119	124
58	Australian, No. 23	32	..	40	..	24	30	29	..	40	30	33	12	122	131	115	130	122	124
59	Chester	31	20	36	40	33	50	28	40	43	30	34	48	121	127	113	130	122	123
60	Stanley	30	40	40	40	31	20	42	40	45	..	38	4	121	130	119	129	116	123
61	Australian, No. 9	30	40	38	..	30	20	28	..	37	..	32	48	123	131	114	130	123	124
62	Cartier	30	..	48	..	31	..	34	20	36	..	35	52	122	128	111	129	119	122
63	Speltz	30	..	43	20	34	40	40	20	37	..	37	4	121	127	113	131	124	123
64	Early Riga	29	20	48	..	28	20	34	20	49	15	37	51	114	124	110	123	113	117
65	Australian, No. 27	29	20	46	40	26	20	35	..	48	30	37	10	123	131	116	130	118	124
66	Angus	28	40	44	.	31	40	27	20	40	45	34	29	120	127	114	130	123	123
67	Australian, No. 25	28	40	41	20	24	..	32	20	40	..	33	16	123	131	115	130	122	124
68	Dufferin	28	..	49	20	31	..	39	20	41	..	37	44	120	128	113	131	115	121
69	Australian, No. 10	27	20	42	..	36	40	31	20	48	..	37	4	123	131	121	130	119	126
70	Goose	26	..	45	20	44	40	51	40	47	..	42	56	122	127	118	129	120	123
71	Cassel	24	..	35	20	28	20	30	40	35	45	30	49	122	127	115	130	118	122

*Much injured by wash from heavy rainstorm.

The twelve varieties of spring wheat which have given the largest crops at the several Experimental Farms in 1902, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Pringle's Champlain	46	..	7. White Russian	42	..
2. Rio Grande	44	..	8. Herisson Bearded	42	..
3. Preston	43	20	9. Admiral	42	..
4. Huron	42	40	10. Blenheim	42	..
5. Red Fern	42	40	11. Hungarian	40	40
6. Roumanian	42	40	12. Dawn	40	40

An average crop of 42 bushels 33 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Japanese	55	20	7. Crown	51	20
2. Norval	55	20	8. Huron	50	20
3. Vernon	54	40	9. Beaudry	50	..
4. Plumper	54	..	10. Benton	50	..
5. Rio Grande	52	20	11. Advance	49	20
6. Hungarian	52	..	12. Dufferin	49	20

An average crop of 52 bushels per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian	46	20	7. Clyde	35	10
2. Goose	44	40	8. Speltz	34	40
3. Campbell's White Chaff	37	40	9. Monarch	34	40
4. Countess	37	20	10. Dawn	34	20
5. Australian No. 10	36	40	11. Benton	34	..
6. White Fife	35	.20	12. Herisson Bearded	34	..

An average crop of 37 bushels 4 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Goose	51	40	7. Plumper	44	40
2. Rio Grande	49	..	8. Dion's	44	..
3. Preston	48	40	9. Herisson Bearded	44	..
4. Red Fern	48	..	10. Percy	44	..
5. Roumanian	47	..	11. Stanley	42	40
6. Colorado	45	40	12. Pringle's Champlain	42	20

An average crop of 45 bushels 58 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Rio Grande..	59	15	7. Minnesota No. 149..	50	30
2. Colorado..	57	30	8. Dawn..	50	..
3. Ladoga..	57	..	9. Captor..	49	30
4. Minnesota No. 181..	56	30	10. Early Riga..	49	15
5. Progress..	52	..	11. Clyde..	49	..
6. Campbell's White Chaff..	51	..	12. Red Swedish..	48	45

An average crop of 52 bushels 31 lbs. per acre.

The twelve varieties of spring wheat which have given the largest crops in 1902, taking the average of the results obtained on all the Experimental Farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Rio Grande..	46	53	7. Plumper..	41	55
2. Roumanian..	45	14	8. Red Fern..	41	49
3. Colorado..	43	54	9. Campbell's White Chaff	41	40
4. Vernon..	43	20	10. Crown..	40	55
5. Goose..	42	56	11. Minnesota No. 181..	40	47
6. Preston..	42	13	12. Herisson Bearded..	40	37

An average crop of 42 bushels 41 lbs. per acre.

The average crop of all the varieties of spring wheat tested at each of the Experimental Farms in 1902, was as follows :—At Ottawa, 36 bushels 26 lbs. per acre ; Nappan, 43 bushels 51 lbs. ; Brandon, 30 bushels 14 lbs. ; Indian Head, 35 bushels 29 lbs., and at Agassiz, 42 bushels 35 lbs. The average return given by the whole of the varieties of spring wheat at all the farms was 37 bushels 33 lbs. per acre.

TRIAL PLOTS OF PEASE.

Fifty-seven varieties of pease were under trial in 1902. These were sown in plots of one-fortieth of an acre each at Ottawa, Ont., Nappan, N.S., and Agassiz, B.C., and one-twentieth of an acre each at Brandon, Man., and Indian Head, N.W.T. The quantity of seed used per acre has varied from two to three bushels, depending on the size of the pea. The dates of sowing were as follows :—At Ottawa, April 23, Nappan, May 7, Indian Head, May 27, and at Agassiz, April 22.

In Canada the bushel of pease is 60 lbs.

UNIFORM TEST PLOTS OF PEASE.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms, Season of 1902.										Number of Days from Sowing to Harvesting				
		Ottawa, Ont.		Nappan, N.S.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.		Ottawa, Ont.	Nappan, N. S.	Indian Head, N.W.T.	Agassiz, B. C.	Average of all Farms.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.
1	Cooper	48	40	25	20	35	20	37	10	36	37	120	120	104	114	114
2	Mackay	46	40	28	40	34	20	40	10	37	27	121	121	106	119	117
3	Pride	46	..	23	20	34	40	38	10	35	32	122	117	103	114	114
4	Nelson	46	..	25	20	30	..	39	10	35	7	117	121	108	111	114
5	Pearl	45	20	24	..	30	20	38	20	34	30	120	121	105	118	116
6	Paragon	45	20	19	20	40	20	36	..	35	15	118	120	108	119	116
7	Arthur	44	40	26	40	39	..	37	50	37	2	117	119	100	113	112
8	Fenton	44	40	18	..	32	40	37	40	33	15	122	120	106	114	115
9	Harrison's Glory	44	40	20	..	42	40	38	30	36	27	122	120	104	113	115
10	Crown	43	20	26	40	45	20	31	40	36	45	121	119	108	119	117
11	Canadian Beauty	43	20	27	20	33	40	35	10	34	52	121	120	108	119	117
12	Prince Albert	42	40	28	40	33	..	38	40	35	45	122	120	106	116	116
13	Alma	42	..	23	20	57	20	35	20	39	30	121	116	104	114	114
14	Kent	42	..	26	..	27	40	35	30	32	47	121	121	108	118	117
15	Prince	42	..	28	..	48	40	45	20	41	..	123	120	104	115	115
16	Early Britain	41	20	29	20	38	20	33	10	35	32	122	116	103	113	113
17	Daniel O'Rourke	40	40	23	20	50	..	28	..	35	30	122	120	97	111	112
18	Golden Vine	40	..	27	20	25	20	41	20	33	30	120	116	108	115	115
19	White Wonder	39	20	24	40	45	..	42	30	37	52	119	120	108	115	115
20	English Grey	38	40	26	40	37	40	29	30	33	7	123	118	102	114	114
21	Prussian Blue	38	..	26	40	35	..	36	30	34	2	120	117	104	115	114
22	Black-eyed Marrowfat	37	20	26	..	32	20	34	40	32	35	125	120	105	114	116
23	Multiplier	37	20	33	20	28	20	35	..	33	30	128	120	108	115	118
24	Chancellor	37	20	25	20	45	20	29	10	34	17	117	119	108	118	115
25	King	37	20	20	40	30	..	38	..	31	30	122	119	108	118	117
26	Duke	37	20	27	20	27	40	29	40	30	30	121	120	106	125	118
27	Carleton	36	..	26	..	37	..	22	10	30	17	124	121	101	122	117
28	Elliot	35	20	23	20	28	..	29	..	28	55	125	120	106	118	117
29	New Potter	35	20	30	..	37	..	32	..	33	35	126	120	105	114	116
30	Trilby	34	40	27	20	22	20	39	30	30	58	122	120	108	114	116
31	Creeper	34	40	30	..	32	..	34	30	32	48	120	120	102	112	114
32	Agnes	34	40	40	..	26	40	41	40	35	45	120	120	108	111	115
33	Vincent	34	..	20	..	25	..	33	40	28	10	123	120	106	116	116
34	Fergus	34	..	28	..	28	20	32	30	30	43	129	121	108	118	119
35	Dover	34	..	30	..	18	20	27	40	27	30	126	121	108	114	117
36	Macoun	34	..	30	40	40	40	32	50	34	33	126	121	106	121	119
37	Wisconsin Blue	34	..	26	..	26	20	27	..	28	20	122	120	108	121	118
38	Archer	33	20	36	.	17	..	30	..	29	5	124	121	109	121	119
39	Elephant Blue	32	40	23	20	18	40	31	..	26	25	122	120	103	115	115
40	Bruce	32	..	28	40	33	..	35	40	32	20	121	121	108	120	118
41	Oddfellow	32	..	24	40	33	20	30	50	30	13	118	120	108	118	116
42	Large White Marrowfat	31	20	28	..	17	40	43	..	30	..	122	120	106	115	116
43	Gregory	31	20	30	.	36	40	32	40	32	40	125	121	108	114	117
44	Victoria	30	40	33	20	30	..	33	20	31	50	127	133	106	121	122
45	Centennial	30	40	24	40	46	..	38	50	35	3	126	121	105	118	118
46	Mummy	30	40	25	20	35	40	40	30	33	3	123	120	104	120	117
47	French Canner	30	..	25	20	36	40	24	20	29	5	119	121	108	116	116
48	Perth	30	..	18	..	35	20	30	40	28	30	122	118	109	114	116
49	Bright	29	20	30	40	30	..	35	..	31	15	124	121	104	114	116
50	Bedford	29	20	34	40	24	20	37	30	31	28	126	120	108	126	120
51	Picton	29	20	30	40	33	40	37	20	32	45	121	120	105	116	116
52	Lanark	28	40	25	20	40	..	33	..	31	45	127	121	105	114	117
53	German White	28	40	25	20	21	..	27	20	25	35	121	116	108	111	114
54	Elder	27	20	20	..	25	40	24	40	24	25	128	121	109	119	119
55	Herald	26	40	30	..	28	40	29	20	28	40	128	123	108	125	121
56	Chelsea	26	..	25	20	19	20	28	40	24	50	125	121	109	126	120
57	Grass Pea	23	20	29	20	frozen		19	30	24	3	133	127	....	136	132

The twelve varieties of pease which have given the largest crops at the several Experimental Farms during 1902, are the following—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Cooper	48	40	7. Arthur	44	40
2. Mackay	46	40	8. Fenton	44	40
3. Pride	46	..	9. Harrison's Glory	44	40
4. Nelson	46	..	10. Crown	43	20
5. Pearl	45	20	11. Canadian Beauty	43	20
6. Paragon	45	20	12. Prince Albert	42	40

An average crop of 45 bushels 7 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Agnes	40	..	7. Bright	30	40
2. Archer	36	..	8. Picton	30	40
3. Bedford	34	40	9. Creeper	30	..
4. Multiplier	33	20	10. New Potter	30	..
5. Victoria	33	20	11. Dover	30	..
6. Macoun	30	40	12. Gregory	30	..

An average crop of 32 bushels 27 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Alma	57	20	7. White Wonder	45	..
2. Daniel O'Rourke	50	..	8. Harrison's Glory	42	40
3. Prince	48	40	9. Macoun	40	40
4. Centennial	46	..	10. Paragon	40	20
5. Crown	45	20	11. Lanark	40	..
6. Chancellor	45	20	12. Arthur	39	..

An average crop of 45 bushels 2 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Prince	45	20	7. Mackay	40	10
2. Large White Marrowfat	43	..	8. Trilby	39	30
3. White Wonder	42	30	9. Nelson	39	10
4. Agnes	41	40	10. Centennial	38	50
5. Golden Vine	41	20	11. Prince Albert	38	40
6. Mummy	40	30	12. Harrison's Glory	38	30

An average crop of 40 bushels 46 lbs. per acre.

The twelve varieties of pease which have given the largest crops in 1902, taking the average results obtained on all the Experimental Farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Prince..	41	..	7. Cooper..	36	37
2. Alma..	39	30	8. Harrison's Glory..	36	27
3. White Wonder....	37	52	9. Agnes..	35	45
4. Mackay..	37	27	10. Prince Albert..	35	45
5. Arthur..	37	2	11. Pride..	35	32
6. Crown..	36	45	12. Early Britain..	35	32

An average crop of 37 bushels 6 lbs. per acre.

The average crop of all the varieties of pease tested at each of the Experimental Farms in 1902, was as follows :—At Ottawa, 36 bushels 15 lbs. per acre ; Nappan, 26 bushels 41 lbs. ; Indian Head, 32 bushels 56 lbs., and at Agassiz, 34 bushels. The average return given by the whole of the varieties at all the farms was 32 bushels 56 lbs. per acre.

TRIAL PLOTS OF INDIAN CORN.

The number of varieties of corn tested in 1902 was thirty-six. These were all planted in rows three feet apart and the plants thinned out to six or eight inches apart in the rows. The dates of planting were as follows :—At Ottawa, Ont., May 27, Nappan, N.S., May 30, Brandon, Man., May 31 and June 1, Indian Head, N.W.T., May 29, and at Agassiz, B.C., May 23.

The crop in each case was cut green and put into the silo for the winter feeding of stock. The dates of cutting were Ottawa, September 24, Nappan, October 30, Brandon, September 5, Indian Head, September 8, and at Agassiz, October 10. The yield per acre has been calculated in each case from the weight obtained from two rows each 66 feet long.

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF INDIAN CORN.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms Season of 1902.											
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.
1	Eureka	32	460	25	600	16	736	7	124	13	1500	18	1884
2	North Dakota Yellow	31	1800	20	1250	17	1904	6	408	15	140	18	700
3	Salzer's All Gold	30	60	23	1300	19	16	9	1800	22	1320	21	99
4	King Philip	28	320	19	1270	15	1680	8	1820	18	1840	18	586
5	Early Butler	26	1020	22	1100	16	472	8	1080	21	680	19	70
6	Thoroughbred White Flint	26	360	24	1500	13	928	8	368	30	1600	20	1351
7	Mamm. Eight-rowed Flint	26	140	23	750	18	432	3	72	19	880	18	455
8	Country Gentleman	25	1700	17	650	13	400	1	1300	18	1950	15	800
9	Superior Fodder	25	300	22	1100	15	888	4	1768	22	660	18	143
10	White Cap Yellow Dent	24	1500	22	550	8	896	6	804	16	230	15	1196
11	Sanford	24	1280	20	700	8	104	6	1068	16	780	15	386
12	North Dakota White	24	840	19	1050	16	1264	4	184	17	320	16	732
13	Comptons Early	24	400	22	1100	15	624	8	368	18	520	17	1402
14	Giant Prolific Ensilage	24	400	25	600	11	1760	7	1840	22	1760	18	872
15	Pearce's Prolific	24	400	20	150	16	1528	8	1688	18	1180	17	1339
16	Pride of the North	23	1520	21	1450	14	1040	7	1708	25	1480	18	1439
17	Selected Leaming	23	1300	18	1400	11	1760	9	348	17	100	16	182
18	Mammoth Cuban	22	1320	21	900	14	1832	6	1464	20	1690	17	641
19	Red Cob Ensilage	22	1100	22	....	11	440	6	1332	22	440	16	1862
20	Early Golden Surprise	22	....	17	650	13	1192	3	1656	17	650	14	1629
21	King of the Earliest	20	920	19	550	16	1000	7	1972	21	460	17	180
22	Champion White Pearl	20	700	18	850	18	696	8	206	22	880	17	1066
23	Longfellow	20	700	22	....	14	1040	5	296	14	1040	15	615
24	Angel of Midnight	20	....	19	550	15	624	4	1900	16	1660	15	547
25	Black Mexican	20	....	20	1250	10	1648	6	1596	16	120	14	1723
26	Yellow Six Weeks	19	1160	12	1850	11	968	6	1200	11	1760	12	988
27	Evergreen Sugar	18	1840	22	....	13	1720	6	12	18	960	15	1706
28	Early Yellow Long Eared	18	1620	19	1600	11	1760	6	1860	22	....	15	1768
29	Cloud's Early Yellow	18	960	17	1750	11	176	5	1088	18	1740	14	743
30	Canada White Flint	17	760	22	1100	11	1760	3	72	16	450	14	428
31	Early Mastodon	17	760	18	1400	14	1568	2	356	22	220	15	61
32	Mitchell's Early	17	760	12	200	12	1080	7	134	11	1650	12	365
33	Salzer's Earliest Ripe	17	100	12	750	11	1760	3	1920	15	1900	12	486
34	Extra Early Huron	16	1220	16	1000	11	704	4	1636	24	1500	14	1612
35	Kendall's Early Giant	14	1920	17	1750	13	400	3	468	17	760	13	659
36	Early August	3	1920		*	9	160	1	1696		†	5	259

* Not sown. † Seed did not germinate.

The six varieties of Indian corn which have given the heaviest crops at the several Experimental Farms during 1902, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Eureka	32	460	4. King Philip	28	320
2. North Dakota Yellow	31	1,800	5. Early Butler	26	1,020
3. Salzer's All Gold	30	60	6. Thoro'bred White Flint	26	360

An average crop of 29 tons 337 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant Prolific Ensilage..	25	600	4. Salzer's All Gold..	23	1,300
2. Eureka....	25	600	5. Mamm. Eight-rowed Flint.... ..	23	750
3. Thoro'bred White Flint..	24	1,500	6. Salzer's Superior Fodder..	22	1,100

An average crop of 24 tons 142 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Salzer's All Gold..	19	16	4. North Dakota Yellow..	17	1,904
2. Champion White Pearl	18	696	5. Pearce's Prolific..	16	1,528
3. Mamm. Eight-rowed Flint..	18	432	6. North Dakota White..	16	1,264

An average crop of 17 tons 1,640 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Salzer's All Gold....	9	1,800	4. Pearce's Prolific..	8	1,688
2. Selected Leaming..	9	348	5. Early Butler..	8	1,080
3. King Philip..	8	1,820	6. Thoro'bred White Flint..	8	368

An average crop of 8 tons 1,847 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Thoro'bred White Flint..	30	1,600	4. Giant Prolific Ensilage	22	1,760
2. Pride of the North..	25	1,480	5. Salzer's All Gold..	22	1,320
3. Extra Early Huron..	24	1,500	6. Champion White Pearl	22	880

An average crop of 24 tons 1,757 lbs. per acre.

The six varieties of Indian corn which have given the heaviest crops in 1902, taking the average of the results obtained on all the Experimental Farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Salzer's All Gold..	21	99	4. Eureka..	18	1,884
2. Thoro'bred White Flint..	20	1,351	5. Pride of the North..	18	1,439
3. Early Butler..	19	70	6. Giant Prolific Ensilage..	18	872

An average crop of 19 tons 952 lbs. per acre.

The average crop of all the varieties, cut green, of Indian corn tested at each of the Experimental Farms in 1902, was as follows :—At Ottawa, 22 tons 155 lbs. per acre ; Nappan, 20 tons 162 lbs. ; Brandon, 13 tons 1,432 lbs. ; Indian Head, 6 tons

156 lbs., and at Agassiz, 19 tons 81 lbs. The average return given by the whole of the varieties at all the farms was 16 tons 140 lbs. per acre.

TRIAL PLOTS OF TURNIPS.

Thirty varieties of turnips were tested in 1902, sown on drills or on the flat 2½ feet apart. Two sowings were made at each farm, the second sowing about two weeks later than the first. The dates of sowing will be found in the accompanying table ; the dates on which the roots were pulled were as follows :—At Ottawa, Ont., October 14, Nappan, N.S., October 30, Brandon, Man., October 2, Indian Head, N.W.T., October 4, and at Agassiz, B.C., October 24. The yield per acre in each case has been calculated from the weight of roots gathered from two rows, each 66 feet long.

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF TURNIPS.

Number.	Name of Variety.	Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Sown May 12.	Sown May 26.	Sown May 21.	Sown June 5.	Sown May 26	Sown June 9.	Sown May 28.	Sown June 7.	Sown May 22	Sown June 5.	First Sowing.	Second Sowing.
		Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.
1	East Lothian	53 1,910	34 1,960	38 230	28 100	14 1,568	16 1,264	15 1,680	13 640	20 920	27 780	28 1,251	24 149
2	Good Luck	52 280	29 740	45 750	34 475	19 16	22 616	17 680	13 860	25 160	28 1,420	31 1,577	25 1,226
3	Halewood's Bronze Top	49 670	30 1,710	42 975	36 1,425	15 1,152	18 1,488	17 320	12 1,440	23 1,355	27 1,440	29 1,294	25 700
4	Jumbo	48 360	22 880	34 805	27 1,275	17 56	15 1,680	14 1,400	13 400	28 265	28 1,420	28 977	21 1,131
5	Hall's Westbury	46 1,720	28 1,420	45 750	37 1,075	15 624	15 1,416	15 480	11 80	28 100	30 720	30 335	24 1,342
6	Imperial Swede	46 1,720	28 1,090	41 830	31 1,855	9 1,272	20 1,976	16 1,960	12 1,920	23 1,520	29 740	27 1,460	24 1,516
7	Emperor Swede	46 1,390	36 1,260	38 725	28 1,750	11 1,760	17 56	14 1,520	12 1,680	26 140	28 1,420	25 1,107	24 1,633
8	Magnum Bonum	46 730	33 660	47 380	37 250	19 544	20 392	15 120	10 640	24 675	27 120	30 889	25 1,212
9	Giant King	46 400	30 60	47 50	34 1,795	15 360	16 1,264	16 160	11 800	23 1,850	23 1,530	29 1,364	23 689
10	Elephant's Master	45 1,740	25 490	49 1,000	38 1,150	13 1,984	16 208	14 920	6 480	23 860	26 1,460	29 901	22 1,157
11	New Century	45 750	21 1,560	36 600	29 475	13 1,984	17 1,640	14 1,280	13 1,600	24 1,500	30 70	27 23	22 1,069
12	Bangholm Selected	44 1,430	33 660	42 1,800	36 1,755	19 1,600	20 1,184	16 880	10 1,600	20 590	26 1,865	28 1,660	25 1,413
13	Mammoth Clyde	44 770	26 470	40 25	28 1,750	10 1,384	21 1,560	15 1,800	12 960	Not sown.	Not sown.	27 1,495	22 685
14	Prize Winner	44 770	29 1,400	38 1,055	29 905	15 96	21 768	15 1,920	11 1,040	27 120	28 430	28 392	24 108
15	Champion Purple Top	44 110	31 1,690	41 1,655	31 1,405	21 1,824	26 536	14 1,400	12 960	26 470	30 70	29 1,492	26 932
16	Shamrock Purple Top	44 110	29 1,730	42 1,305	36 600	18 168	20 920	15 480	11 1,520	22 880	30 60	28 988	25 1,366
17	Drummond Purple Top	43 1,120	27 1,110	44 1,430	35 125	13 1,720	21 504	14 1,640	12 1,200	26 1,130	28 1,090	28 1,408	25 5
18	Perfection Swede	43 790	25 820	46 1,555	38 395	18 432	23 1,784	16 160	14 800	25 1,448	24 840	30 77	25 528
19	Prize Purple Top	42 810	26 1,130	46 400	38 1,055	15 888	20 920	14 920	12 920	25 820	26 140	28 1,567	24 1,633
20	Kangaroo	42 480	28 100	45 255	34 475	18 1,224	21 504	14 1,160	12	26 800	25 160	29 784	24 248
21	Skirvings	39 1,860	19 940	37 1,900	28 1,750	25 424	18 696	13 280	9 720	27 440	26 140	28 1,381	20 849
22	Selected Purple Top	39 1,530	29 80	41 500	31 205	13 400	19 544	13 1,960	11 80	25 160	27 1,440	26 1,310	23 1,269
23	Marquis of Lorne	39 1,200	24 1,830	40 1,675	32 350	15 888	17 1,904	14 560	12 240	26 1,955	26 470	27 855	22 1,359
24	Monarch	38 1,880	25 1,150	36 1,425	27 1,275	12 1,344	16 1,000	14 1,640	11 80	24 675	20 920	25 993	20 485
25	Carter's Elephant	37 910	21 1,230	45 1,905	36 1,525	13 1,456	15 360	14 1,040	14 320	31 40	32 1,670	28 1,070	24 221
26	New Arctic	36 930	27 1,440	42 1,140	31 700	20 1,976	21 768	16 160	12 720	24 840	26 140	28 209	23 1,553
27	West Norfolk Red Top	35 1,610	19 610	44 605	35 950	15 888	16 208	12 1,560	9 960	20 425	21 240	25 1,417	20 593
28	Selected Champion	28 1,420	24 1,170	41 5	34 1,300	16 472	13 400	Not sown.	Not sown.	16 1,660	19 1,600	25 1,389	23 117
29	Sutton's Champion	22 1,540	21 1,890	50 155	42 975	17 1,112	19 280	15 1,320	10 1,600	21 240	28 1,090	25 873	24 1,167
30	Webb's New Renown	20 1,580	20 260	35 125	27 450	21 504	23 464	17 440	18 1,680	19 160	16 1,330	22 1,362	21 437

The crops of the two sowings of turnips at the Experimental Farms in 1902 have averaged per acre as follows :—

Central Experimental Farm, first sowing..	42	84
" second sowing	27	318
Experimental Farm, Nappan, first sowing..	42	667
" Nappan, second sowing	33	786
" Brandon, first sowing	16	604
" Brandon, second sowing..	19	377
" Indian Head, first sowing	15	546
" Indian Head, second sowing....	12	68
" Agassiz, first sowing	24	834
" Agassiz, second sowing..	26	1,335

Average crop from all the plots at all the farms, first sowing 28 tons 196 lbs, second sowing 23 tons 1,494 lbs., showing an advantage in favour of the first sowing of 4 tons 702 lbs. per acre. It will be seen that the early sown plots have given the larger crops at all the experimental farms, excepting at Brandon and Agassiz, where the later sown crops have given the heavier yields.

The six varieties of turnips which have given the heaviest crops at the several experimental farms during the season of 1902, are the following :—

(Where not otherwise stated the quantities given are all from the early sown plots.)

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. East Lothian..	53	1,910	4. Jumbo..	48	360
2. Good Luck..	52	280	5. Hall's Westbury..	46	1,720
3. Halewood's Bronze Trop....	49	670	6. Imperial Swede..	46	1,720

An average crop of 49 tons 1,110 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Sutton's Champion..	50	155	4. Giant King..	47	50
2. Elephant's Master..	49	1,000	5. Perfection Swede..	46	1,555
3. Magnum Bonum..	47	380	6. Prize Purple Top..	46	400

An average crop of 47 tons 1,589 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Champion Purple Top (2nd sowing)	26	536	4. Webb's New Renown (2nd sowing)..	23	464
2. Skirvings..	25	424	5. Good Luck (2nd sowing)..	22	616
3. Perfection Swede (2nd sowing)....	23	1,784	6. Mammoth Clyde (2nd sowing)..	21	1,560

An average crop of 23 tons 1,731 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Webb's New Renown (2nd sowing)	18	1,680	4. Imperial Swede..	16	1,960
2. Good Luck..	17	680	5. Bangholm Selected..	16	880
3. Halewood's Bronze Top	17	320	6. Perfection Swede	16	160

An average crop of 17 tons 280 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Carter's Elephant (2nd sowing)..	32	1,670	4. New Century (2nd sowing)	30	70
2. Hall's Westbury (2nd sowing) ..	30	720	5. Shamrock Purple Top (2nd sowing)..	30	60
3. Champion Purple Top (2nd sowing)	30	70	6. Imperial Swede (2nd sowing) ..	29	740

An average crop of 30 tons 888 lbs. per acre.

The six varieties of turnips which have produced the heaviest crops in 1902, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Good Luck..	31	1,577	4. Perfection Swede..	30	77
2. Magnum Bonum..	30	889	5. Champion Purple Top..	29	1,492
3. Hall's Westbury..	30	335	6. Giant King..	29	1,364

An average crop of 30 tons 622 lbs. per acre.

TRIAL PLOTS OF MANGELS.

Twenty-seven varieties of mangels have been under test during 1902, all were sown on drills or on the flat in rows 2½ feet apart. Two sowings were made at each farm, the second sowing about two weeks later than the first. The dates of sowing will be found in the accompanying table ; the dates on which the roots were pulled were as follows :—At Ottawa, Ont., October 14, Nappan, N.S., October 28, Brandon, Man., September 20, Indian Head, N.W.T., October 3, and at Agassiz, B.C., October 22. The yield per acre has been calculated in each case from the weight of roots gathered from two rows each 66 feet long.

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF MANGELS.

Number.	Name of Variety.	Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N. W. T.		Agassiz, B.C.		Average of all Farms.	
		Sown May 12.	Sown May 26.	Sown May 20.	Sown June 4.	Sown May 27.	Sown June 10.	Sown May 28.	Sown June 7.	Sown May 6.	Sown May 20.	First Sowing.	Second Sowing.
		Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.	Per acre. Tons. lbs.
1	Mammoth Long Red	55 550	35 1,490	41 1,490	34 475	12 1,344	17 584	13 1,480	9 480	51 1,620	37 580	35 97	26 1,522
2	Norbiton Giant.....	52 280	30 720	37 1,900	24 1,170	12 288	17 320	11 920	8 560	38 1,220	31 40	30 922	22 562
3	Triumph Yellow Globe....	51 1,950	36 930	38 65	36 1,590	11 1,232	14 1,304	13 1,600	11 80	31 700	26 865	29 709	25 154
4	Mam. Yellow Intermediate.	51 300	37 1,240	45 915	35 1,445	10 1,912	13 1,192	13 760	7 1,840	32 1,670	33 330	30 1,511	25 1,209
5	Lion Yellow Intermediate .	50 1,970	36 600	50 1,145	40 1,840	13 1,984	16 1,792	13 280	9	47 1,700	38 880	35 616	28 622
6	Mammoth Oval Shaped....	49 1,000	32 680	38 725	28 1,255	10 1,912	14 1,832	11 1,040	7 1,600	41 830	27 285	30 701	22 330
7	Prize Winner Yellow Globe	47 50	32 20	40 25	36 270	13 664	15 1,152	13 40	8 1,760	36 1,590	26 800	30 73	23 1,600
8	Yellow Intermediate.	46 1,060	35 1,280	40 190	35 775	14 248	15 96	14 320	10 400	42 1,140	38 1,220	31 992	26 1,954
9	Leviathan Long Red.....	44 1,760	35 620	31 865	30 225	10 1,232	15 96	13 1,000	10 160	31 40	30 1,050	26 579	24 430
10	Selected Mamm. Long Red.	44 440	30 1,710	36 1,755	35 125	13 669	14 1,849	12 480	9 960	45 750	37 1,900	30 819	25 1,309
11	Prize Mamm. Long Red...	43 1,450	25 1,150	37 1,075	31 1,525	11 176	15 1,152	13 1,240	6 1,680	41 1,820	36 270	29 1,152	23 355
12	Warden Orange Globe.....	43 1,120	30 390	38 230	28 1,420	5 32	14 1,304	11 1,040	5 1,280	48 360	34 1,630	29 556	22 1,405
13	Canadian Giant.....	42 1,470	30 1,380	38 1,220	32 1,375	11 1,496	15 360	11 1,040	9	42 975	34 970	29 840	24 817
14	Gate Post..... ..	41 1,820	31 700	44 935	36 105	11 440	15 888	12 1,440	8 1,280	37 1,570	36 1,920	29 1,241	25 1,379
15	Giant Yellow Globe.....	41 830	27 1,110	37 580	29 245	7 1,576	14 1,040	12 240	8 1,040	41 500	32 680	27 1,945	22 823
16	Ward's Large Oval Shaped.	40 850	26 1,130	33 1,650	26 1,625	10 988	15 1,152	15 240	6 240	43 1,285	38 230	28 1,403	22 1,275
17	Selected Yellow Globe.....	39 540	26 1,460	47 50	37 745	15 1,944	17 1,376	14 200	10 1,600	38 890	28 430	30 1,925	24 322
18	Half Long Sugar White....	39 210	29 740	40 355	32 1,505	12 552	15 96	13 880	9 1,200	46 400	36 1,920	30 499	24 1,492
19	Champion Yellow Globe...	38 1,880	30 1,050	46 235	37 1,570	13 1,456	14 1,304	11 320	9 . ..	42 1,800	32 1,505	30 1,138	24 1,886
20	Giant Sugar Mangel.....	38 230	31 700	38 1,715	33	9 1,800	14 776	10 1,840	8 800	40 685	28 100	27 1,254	23 75
21	Gate Post Yellow.....	36 270	33 660	39 210	34 1,960	10 1,120	14 1,040	12 1,320	9 1,440	32 1,340	31 1,690	26 452	24 1,758
22	Half Long Sugar Rosy.....	35 1,610	25 820	35 1,280	33 1,320	16 1,132	11 704	13 520	6 1,440	40 25	42 1,800	28 513	24 17
23	Yellow Fleshed Tankard...	33 1,980	25 1.810	41 500	34 970	11 176	10 1,912	13 280	7 400	36 1,920	26 800	27 571	20 1,978
24	Giant Yellow Half Long...	32 1,340	20 590	44 1,760	35 1,445	7 1,048	17 584	14 1,640	8 1,520	36 600	26 1,460	27 478	21 1,520
25	Giant Yellow Intermediate.	25 1,150	20 920	44 1,595	36 1,425	11 1,892	15 1,152	15 600	8 1,040	45 1,080	36 1,590	28 1,263	23 1,225
26	Golden Fleshed Tankard...	23 200	21 900	41 1,490	33 1,485	8 1,952	13 1,720	13 880	7 880	36 1,260	32 1,670	24 1,556	21 1,731
27	Red Fleshed Tankard.....	22 1,540	20 1,580	36 1,425	28 1,225	11 176	15 1,152	12 1,200	9 960	Not sown.	Not sown.	20 1,585	18 1,229

The crops from the two sowings of mangels at the Experimental Farms in 1902 have averaged per acre as follows :—

Central Experimental Farm, first sowing	41 tons.	439 lbs.
" " " second sowing	29 "	1,273 "
Experimental Farm, Nappan, first sowing	40 "	495 "
" " " second sowing	33 "	782 "
" " Brandon, first sowing	11 "	1,016 "
" " " second sowing	15 "	146 "
Experimental Farm, Indian Head, first sowing	13 tons.	31 lbs.
" " " second sowing	8 "	1,309 "
" " Agassiz, first sowing	40 "	837 "
" " " second sowing	33 "	408 "

Average crop from all the plots at all the farms ; first sowing, 29 tons 273 lbs., second sowing, 23 tons 999 lbs., showing an advantage in favour of early sowing of 5 tons 1,274 lbs. per acre.

The six varieties of mangels which have produced the heaviest crops at the several experimental farms during 1902, are the following. (Unless otherwise stated the yields given are all from the earliest sown plots) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth Long Red....	55	550	4. Mamm. Yellow Intermediate ..	51	300
2. Norbiton Giant..	52	280	5. Lion Yellow Intermediate... ..	50	1,970
3. Triumph Yellow Globe..	51	1,950	6. Mammoth Oval Shaped..	49	1,000

An average crop of 51 tons 1,675 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Lion Yellow Intermediate..	50	1,145	4. Mamm. Yellow Intermediate.. ..	45	915
2. Selected Yellow Globe..	47	50	5. Giant Yellow Half Long..	44	1,760
3. Champion Yellow Globe..	46	235	6. Giant Yellow Intermediate.. ..	44	1,595

An average crop of 46 tons 950 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Selected Yellow Globe (2nd sowing)	17	1,376	4. Norbiton Giant (2nd sowing) ..	17	320
2. Mamm. Long Red (2nd sowing)..	17	584	5. Lion Yellow Intermediate (2nd sowing)..	16	1,792
3. Giant Yellow Half Long (2nd sowing)..	17	584	6. Half Long Sugar Rosy..	16	1,132

An average crop of 17 tons 298 lbs per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant Yellow Intermediate..	15	600	4. Yellow Intermediate	14	320
2. Ward's Large Oval-shaped..		240	5. Selected Yellow Globe..	14	200
3. Giant Yellow Half Long..	14	1,640	6. Triumph Yellow Globe..	13	1,600

An average crop of 14 tons 1,100 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth Long Red..	51	1,620	4. Half Long Sugar White..	46	400
2. Warden Orange Globe..	48	360	5. Giant Yellow Intermediate	45	1,080
3. Lion Yellow Intermediate..	47	1,700	6. Selected Mamm. Long Red	45	750

An average crop of 47 tons 985 lbs. per acre.

The six varieties of mangels which have produced the heaviest crops in 1902, taking the average of the results obtained on all the experimental farms are :

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Lion Yellow Intermediate..	35	616	4. Selected Yellow Globe..	30	1,925
2. Mammoth Long Red..	35	97	5. Mamm. Yellow Intermediate.. ..	30	1,511
3. Yellow Intermediate..	31	996	6. Champion Yellow Globe	30	1,138

An average crop of 32 tons 714 lbs per acre.

TRIAL PLOTS OF CARROTS.

Twenty different sorts of carrots were tested during 1902, all sown on drills or on the flat two feet apart. Two sowings were made in each case, the second sowing two weeks later than the first. The dates of sowing will be found in the accompanying table ; the dates on which the carrots were pulled were as follows :—At Ottawa, Ont., October 14, Nappan, N.S., October 24, Brandon, Man., October 2, Indian Head, N.W.T., October 5, and at Agassiz, B.C., October 28. The yield per acre in each case has been calculated from the weight of roots gathered from two rows, each 66 feet long.

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF CARROTS.

Number.	Name of Variety.	Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Sown May 12.	Sown May 26.	Sown May 21.	Sown June 5.	Sown May 27.	Sown June 10.	Sown April 30.	Sown May 28.	Sown May 6.	Sown May 20.	First Sowing.	Second Sowing.
		Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.	Per acre. Tons. Lbs.
1	Carter's Orange Giant	39 1,200	21 900	15 855	17 815	12 200	9 1,800	10 1,360	7 640	31 700	30 1,710	21 1,063	17 773
2	Mamm. White Intermediate	35 1,610	28 100	21 240	18 300	5 120	14 1,480	11 1,760	7 1,600	40 520	31 370	22 1,650	19 1,970
3	Half Long White	35 620	26 800	22 550	20 1,745	7 960	9 1,800	14 800	10 1,360	29 1,520	29 1,730	21 1,690	19 1,067
4	Improved Short White	33 990	28 760	21 900	16 340	7 80	5 1,880	13 840	10 400	40 190	39 540	23 200	19 1,984
5	Iverson's Champion	33 990	29 1,730	21 405	19 1,435	8 720	11 880	17 1,280	10 160	38 1,220	32 680	23 1,723	20 1,377
6	Giant White Vosges	33 330	27 1,770	20 1,250	17 650	9 40	9 1,800	16 1,120	8 1,040	46 400	38 1,640	25 228	20 980
7	Green Top White Orthe	31 1,360	24 1,500	21 900	20 1,085	11 1,320	13 1,280	14 1,760	8 1,760	39 540	34 1,795	23 1,576	20 1,084
8	Half Long Chantenay	31 1,030	27 780	16 505	17 815	9 1,360	12 640	14 560	9	27 285	22 395	19 1,548	17 1,326
9	Ontario Champion	31 1,030	24 1,830	20 755	17 815	14 160	11	14 1,520	8 560	33 660	25 820	22 1,625	17 805
10	New White Intermediate	30 1,380	26 800	21 75	17 1,310	16 120	9 1,800	15 960	7 880	38 1,055	34 970	24 718	19 352
11	Long Yellow Stump Rooted	27 1,440	21 1,890	19 610	15 360	9 480	12 640	14 80	8 560	20 920	17 1,970	18 306	15 284
12	Guerande or Ox-heart	26 1,130	26 470	15 1,350	13 1,885	9 40	13 1,840	11 1,280	5 1,520	22 1,870	21 1,560	17 334	16 655
13	White Vosges, Large Short	24 1,830	20 200	16 1,660	13 1,555	11 1,320	10 680	9 1,680	5 1,760	40 400	31 310	20 1,378	16 513
14	White Belgian	24 180	20 920	19 1,930	15 360	9 1,800	9 40	11 1,760	6 960	42 1,800	39 1,200	21 1,494	18 296
15	Yellow Intermediate	24 180	17 980	22 220	18 1,455	11	11 1,320	10 1,000	5 1,760	23 1,190	21 1,890	18 518	15 281
16	Long Scarlet Altringham	23 1,520	15 30	17 650	14 1,865	3 1,480	4 800	7 640	5 1,040	16 1,990	16 670	13 1,656	11 481
17	Early Gem	22 1,210	22 880	14 875	12 585	7 1,840	9 480	12 600	7 400	25 160	21 1,890	16 937	14 1,247
18	Long Orange or Surrey	17 1,640	14 1,700	14 1,700	13 1,720	6 320	5 1,880	11 200	6 480	18 960	16 1,660	13 1,364	11 1,088
19	Scarlet Intermediate	16 1,000	15 690	16 1,000	14 1,700	6 1,640	10 240	8 680	7 400	20 590	18 1,620	13 1,382	13 530
20	Scarlet Nantes	14 1,040	11 1,100	15 525	13 400	3 160	4 360	6 120	4 640	17 320	16 505	11 433	9 1,801

The crops from the two sowings of carrots at the experimental farms in 1902, have averaged as follows:—

	Tons.	Lbs.
Central Experimental Farm, first sowing	27	1,885
" " second sowing	22	1,094
Experimental Farm, Nappan, first sowing	18	1,347
" " second sowing	16	860
" Brandon, first sowing	8	1,908
" " second sowing	9	1,992
" Indian Head, first sowing	12	700
" " second sowing	7	1,096

	Tons.	Lbs.
Experimental Farm, Agassiz, first sowing	30	1,264
" " second sowing	27	171

Average crop from all the plots at all the farms: first sowing, 19 tons 1,421 lbs.; second sowing, 16 tons 1,446 lbs.; showing an advantage in favour of the early sown plots of 2 tons 1,975 lbs. per acre.

The six varieties of carrots which have produced the heaviest crops at the several experimental farms during the season of 1902, are the following. (Unless otherwise stated, the yields given are all from the earliest sown plots):—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Carter's Orange Giant..	39	1,200	4. Improved Short White..	33	990
2. Mamm. White Intermediate..	35	1,610	5. Iverson's Champion..	33	990
3. Half Long White..	35	620	6. Giant White Vosges..	33	330

An average crop of 35 tons 290 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Half Long White..	22	550	4. Green Top White Orthe..	21	900
2. Yellow Intermediate....	22	220	5. Iverson's Champion..	21	405
3. Improved Short White..	21	900	6. Mamm. White Intermediate.. ..	21	240

An average crop of 21 tons 1,202 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate..	16	120	4. Guerande or Ox-heart (2nd sowing)..	13	840
2. Mamm. White Intermediate (2nd sowing)..	14	1,480	5. Half Long Chantenay..	12	640
3. Green Top White Orthe (2nd sowing)..	13	1,280	6. Long Yellow Stump Rooted.. ..	12	640

An average crop of 13 tons 1,500 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Iverson's Champion..	17	1,280	4. Green Top White Orthe..	14	1,760
2. Giant White Vosges..	16	1,120	5. Ontario Champion..	14	1,520
3. New White Intermediate..	15	960	6. Half Long White..	14	800

An average crop of 15 tons 1,240 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant White Vosges..	46	400	4. White Vosges Large Short	40	400
2. White Belgian..	42	1,800	5. Improved Short White..	40	190
3. Mamm, White Intermediate..	40	520	6. Green Top White Orthe	39	540

An average crop of 41 tons 975 lbs. per acre.

The six varieties of carrots which have produced the heaviest crops in 1902, taking the average of the results obtained on all the experimental farms, are the following:—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant White Vosges..	25	228	4. Green Top White Orthe..	23	1,576
2. New White Intermediate..	24	718	5. Improved Short White..	23	200
3. Iverson's Champion....	23	1,723	6. Mamm. White Intermediate.. ..	22	1,650

An average crop of 23 tons 1,682 lbs. per acre.

TRIAL PLOTS OF SUGAR BEETS.

Eight varieties of sugar beets have been tested during 1902, sown on drills or on the flat two feet apart. Two sowings were made at each farm, the second sowing about two weeks later than the first. The dates of sowing will be found in the accompanying table; the dates on which the roots were pulled, were as follows:—At Ottawa, Ont., October 14, Nappan, N.S., October 28, Brandon, Man., September 20, Indian Head, N.W.T., October 3, and at Agassiz, B.C., October 22. The yield per acre in each instance has been calculated from the weight of roots gathered from two rows, each 66 feet long.

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF SUGAR BEETS.

Number.	Name of Variety.	Ottawa, Ont.				Nappan, N.S.				Brandon, Man.				Indian Head, N.W.T.				Agassiz, B.C.				Average of All Farms.			
		Sown May 12.		Sown May 26.		Sown May 20.		Sown June 4.		Sown May 27.		Sown June 10.		Sown May 28.		Sown June 7.		Sown May 7.		Sown May 21.		First Sowing.		Second Sowing.	
		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Royal Giant.....	38	1,880	28	1,750	37	1,240	34	1,300	8	1,424	14	1,040	10	400	9	480	37	580	26	140	26	1,105	22	1,342
2	Danish Improved.....	37	1,570	30	720	32	120	24	1,830	12	24	14	512	10	1,720	8	1,040	38	230	26	1,460	26	333	20	1,912
3	Danish Red Top.....	37	1,570	33	.....	31	1,525	25	325	8	500	13	1,192	9	1,200	5	1,520	29	1,730	25	1,580	23	905	20	1,323
4	Red Top Sugar.	35	1,940	25	1,150	30	1,380	25	820	13	928	12	24	8	560	9	.....	27	1,935	26	305	23	549	19	1,260
5	Improved Imperial.....	31	700	27	450	28	1,255	24	1,500	6	672	12	1,344	7	1,720	7	640	26	470	19	1,600	20	163	18	707
6	Wanzleben.....	28	1,420	21	900	28	925	20	1,250	7	1,048	12	552	7	1,480	6	1,920	26	1,460	27	780	19	1,667	17	1,480
7	Vilmorin's Improved.....	27	780	20	1,580	20	1,250	17	1,475	5	296	12	288	8	680	5	320	23	200	24	840	16	1,841	16	101
8	French Very Rich	23	1,190	17	650	23	200	18	300	8	1,160	9	1,800	5	1,880	6	960	26	635	26	800	17	1,013	15	1,302

The crops from the two sowings of sugar beets at the experimental farms in 1902 have averaged as follows:

	Tons.	Lbs.
Central Experimental Farm, first sowing...	32	1,382
" " second sowing.	25	1,150
Experimental Farm, Nappan, first sowing.	29	237
" " " second sowing.	23	1,850
" " Brandon, first sowing	8	1,507
" " " second sowing.	12	1,344
" " Indian Head, first sowing.	8	1,205
" " " second sowing	7	610
" " Agassiz, first sowing.	29	905
" " " second sowing.	25	688

Average crop from all the plots at all the farms: first sowing, 21 tons, 1,447 lbs.; second sowing, 18 tons, 1,928 lbs.; showing an advantage in favour of early sowing of 2 tons, 1,519 lbs. per acre.

The four varieties of sugar beets which have produced the heaviest crops at the several experimental farms during the season of 1902, are the following. (Unless otherwise stated, the yields given are all from the earliest sown plots) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Royal Giant..	38	1,880	3. Danish Red Top..	37	1,570
2. Danish Improved..	37	1,570	4. Red Top Sugar..	35	1,940

An average crop of 37 tons 1,240 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Royal Giant..	37	1,240	3. Danish Red Top..	31	1,525
2. Danish Improved....	32	120	4. Red Top Sugar..	30	1,380

An average crop of 33 tons 66 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Royal Giant (2nd sowing)..	14	1,040	3. Danish Red Top (2nd sowing) ..	13	1,192
2. Danish Improved (2nd sowing) ..	14	512	4. Red Top Sugar..	13	928

An average crop of 13 tons 1,918 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Improved....	10	1,720	3. Danish Red Top..	9	1,200
2. Royal Giant..	10	400	4. Red Top Sugar (2nd sowing)..	9	..

An average crop of 9 tons 1,830 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Improved..	38	230	3. Danish Red Top..	29	1,730
2. Royal Giant..	37	580	4. Red Top Sugar..	27	1,935

An average crop of 33 tons 619 lbs. per acre.

The four varieties of sugar beets which have produced the heaviest crops in 1902, taking the average of the results obtained on all the experimental farms are :

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Royal Giant..	26	1,105	3. Danish Red Top..	23	903
2. Danish Improved..	26	333	4. Red Top Sugar..	23	549

An average crop of 24 tons 1,722 lbs. per acre.

TRIAL PLOTS OF POTATOES.

Ninety varieties of potatoes have been under test during 1902. The potatoes planted were cut into pieces, with two or three eyes in each, and these were planted in rows 2½ feet apart, the sets being placed a foot apart in the rows. The following were the dates of planting and digging :—At Ottawa, Ont., planted May 27, dug October 2; Nappan, N.S., planted May 29, dug October 3; Brandon, Man., planted May 20, dug September 30 ; Indian Head, N.W.T., planted May 7, dug October 2, and at Agassiz, B.C., planted May 14, dug September 22 to 30.

In Canada the bushel of potatoes is 60 lbs.

UNIFORM TEST PLOTS OF POTATOES.

Number.	Name of Variety.	Yield at the Several Experimental Farms, Season of 1902.											
		Ottawa, On		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.
1	Flemish Beauty..	697	24	400	24	267	40	231	..	311	18	381	33
2	Irish Cobbler.....	646	48	385	..	352	..	289	12	361	54	406	59
3	Money Maker.	622	36	424	36	330	..	266	12	369	..	402	29
4	Late Puritan	613	48	376	12	315	20	213	24	297	..	363	9
5	Troy Seedling.	609	24	484	..	238	20	237	36	355	51	385	2
6	Irish Daisy	605	..	473	..	355	40	195	48	385	..	402	54
7	Dakota Red.....	594	..	517	..	223	40	226	36	360	48	384	25
8	Brown's Rot Proof.....	565	24	367	24	245	40	112	12	281	36	314	27
9	Carman No. 1.....	552	12	387	12	231	..	274	24	372	50	363	32
10	Swiss Snow Flake.....	532	24	244	12	260	20	231	..	347	..	322	59
11	Sabean's Elephant	530	12	308	..	311	40	233	12	350	54	346	47
12	American Wonder.....	517	..	363	..	403	20	226	36	328	54	367	46
13	Hale's Champion.....	506	..	462	..	432	40	246	24	275	..	384	25
14	Enormous.....	501	36	495	..	557	20	169	24	327	48	410	14
15	Sharpe's Seedling.....	499	24	422	24	425	20	235	24	367	4	389	55
16	Reeves' Rose.....	497	12	356	24	278	40	261	48	310	12	340	51
17	Rawdon Rose..... .	497	12	375	..	315	20	206	48	308	..	340	28
18	I.X.L.	492	48	356	24	352	..	228	48	235	24	333	5
19	Country Gentleman....	488	24	286	..	352	..	301	24	352	..	355	57
20	Early St. George.	481	48	376	12	381	20	211	12	348	9	359	44
21	Quaker City.	477	24	453	12	326	20	226	36	316	48	360	4
22	Delaware.....	473	..	334	24	429	..	202	24	306	54	349	8
23	Rochester Rose	473	..	444	24	271	20	228	48	289	18	341	22
24	Maule's Thoroughbred .	473	..	303	36	421	40	255	12	386	36	368	1
25	Northern Spy.....	473	..	451	..	282	20	250	36	353	6	362	..
26	Carman No. 3	470	48	451	..	374	..	259	36	216	42	354	25
27	Clay Rose.....	470	48	462	..	315	20	231	..	345	57	365	1
28	Daisy.....	464	12	294	48	319	..	206	48	284	54	313	56
29	Early Norther.....	464	12	473	..	275	..	209	..	383	18	360	54

UNIFORM TEST PLOTS OF POTATOES.

Number.	Name of Variety.	Yield at the Several Experimental Farms, season of 1902.											
		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	
		Per acre Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.	Per acre. Bush.	Lbs.
30	Seattle	464	12	479	36	315	20	266	..	308	..	366	38
31	Burnaby Seedling	462	..	400	24	476	40	248	36	347	50	387	6
32	Lee's Favourite	462	..	319	..	337	20	270	36	288	46	335	32
33	Early Sunrise	457	36	374	..	330	..	202	24	302	30	333	18
34	Thorburn	457	36	336	36	293	20	191	24	228	48	301	33
35	Early Harvest	457	36	259	36	363	..	266	12	342	12	337	43
36	Burpee's Extra Early	453	12	382	48	‡		211	12	321	12	342	6
37	Early Puritan	448	48	374	..	293	20	182	36	361	54	332	7
38	Uncle Sam	442	12	365	12	330	..	235	24	339	54	342	32
39	Empire State	442	12	347	36	454	40	204	36	309	6	351	38
40	State of Maine	442	12	360	48	381	20	239	48	346	30	354	7
41	Penn. Manor	440	..	407	..	289	40	222	22	332	12	338	15
42	Dreer's Standard	440	..	380	36	282	20	242	..	‖		336	14
43	Vick's Extra Early	440	..	440	..	297	..	255	12	302	30	346	56
44	Holborn Abundance	437	48	418	..	319	..	233	12	326	42	346	56
45	Early Market	435	36	391	36	271	20	182	36	369	36	330	9
46	Wonder of the World	435	36	†		‡		226	36	333	16	331	49
47	Columbus	435	36	343	12	‡		253	..	369	..	350	12
48	New Queen	431	12	343	12	381	20	288	12	309	39	350	43
49	Prize Taker	426	48	338	48	205	20	224	24	334	22	305	56
50	Polaris	426	48	297	..	322	40	187	..	344	18	315	33
51	McIntyre	426	48	446	36	278	40	204	36	354	12	342	10
52	Early Michigan	426	48	297	..	315	20	242	..	295	12	315	16
53	Early Rose	422	24	279	24	333	40	217	48	330	..	316	39
54	Canadian Beauty	420	12	499	24	326	20	209	..	351	27	361	16
55	American Giant	415	48	385	..	363	..	266	12	381	40	362	20
56	Seedling No. 7.	413	36	440	..	421	40	272	48	322	18	374	4
57	White Beauty	413	36	393	48	473	..	184	48	363	..	365	38
58	Chicago Market	407	..	319	..	333	40	228	48	347	36	327	12
59	New Variety No. 1	404	48	363	..	370	20	275	..	240	54	330	48
60	Seedling No. 230	404	48	426	48	432	40	228	48	356	24	369	53
61	Rose No. 9.	402	36	495	..	355	40	257	24	366	51	375	30
62	Lizzie's Pride	400	24	391	36	348	20	248	36	293	22	336	27
63	Bovee	400	24	360	48	249	20	235	24	313	20	311	51
64	Rural No. 2.	396	..	451	..	341	..	180	24	238	42	321	25
65	Everett.	391	36	451	12	282	20	182	36	363	..	334	9
66	General Gordon	389	24	378	24	289	40	242	..	367	37	333	25
67	Reading Giant	389	24	275	..	220	..	149	36	‖		258	30
68	Earliest of All	385	..	261	48	304	20	268	24	345	25	312	59
69	Green Mountain	378	24	360	48	271	20	246	24	232	6	297	48
70	Rural Blush	376	12	437	48	238	20	182	36	325	36	312	6
71	Sir Walter Raleigh	374	..	422	24	311	40	154	..	317	54	316	..
72	Great Divide	367	24	495	..	418	..	253	..	341	..	374	53
73	Clarke's No. 1	360	48	323	24	297	..	§		286	..	316	48
74	Early Six Weeks	358	36	312	24	293	20	149	36	342	12	291	14
75	Vanier	354	12	404	48	348	20	169	24	349	58	325	20
76	Up to Date	354	12	213	24	234	40	206	48	225	10	246	51
77	Beauty of Hebron	341	..	338	48	271	20	286	..	323	24	312	6
78	Pearce's Prize Winner	334	24	468	36	278	40	215	46	321	45	323	50
79	Early Ohio	332	12	358	36	231	..	180	24	328	21	286	7
80	Maggie Murphy	321	12	352	..	286	..	228	48	243	6	286	13
81	Cambridge Russet	321	12	389	24	473	..	202	24	345	24	316	17
82	Early Andes	316	48	297	..	289	40	140	48	322	51	273	29
83	Early White Prize	314	36	418	..	447	20	193	36	331	6	340	56
84	Pearce's Extra Early	305	48	404	48	429	.	216	12	347	..	340	34
85	Pride of the Market	277	12	415	48	392	20	266	12	324	30	335	12
86	Bill Nye	275	..	451	..	337	20	187	..	358	36	321	47
87	Brownell's Winner	266	12	253	..	308	.	281	36	357	30	293	16
88	Ohio Junior	259	36	336	36	271	20	145	12	299	12	262	23
89	Houlton Rose	154	..	389	24	487	40	145	12	350	21	305	19
90	Prolific Rose	*		270	36	436	20	231	..	374	30	328	7

* Not planted at Ottawa. † Not planted at Nappan. ‡ Not planted at Brandon. § Not planted at Indian Head. ‖ Not planted at Agassiz.

The twelve varieties of potatoes which have produced the largest crops at the several experimental farms during the season of 1902, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Flemish Beauty	697	24	7. Dakota Red	594	..
2. Irish Cobbler	646	48	8. Brown's Rot Proof	565	24
3. Money Maker	622	36	9. Carman No. 1	552	12
4. Late Puritan	613	48	10. Swiss Snowflake	532	24
5. Troy Seedling	609	24	11. Sabean's Elephant	530	12
6. Irish Daisy	605	..	12. American Wonder	517	..

An average crop of 590 bushels 31 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Dakota Red	517	..	7. Seattle	479	36
2. Canadian Beauty	499	24	8. Early Norther	473	..
3. Enormous	495	..	9. Irish Daisy	473	..
4. Great Divide	495	..	10. Pearce's Prize Winner	468	36
5. Rose No. 9	495	..	11. Clay Rose	462	..
6. Troy Seedling	484	..	12. Hale's Champion	462	..

An average crop of 483 bushels 38 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Enormous	557	20	7. Early White Prize	447	20
2. Houlton Rose	487	40	8. Prolific Rose	436	20
3. Burnaby Seedling	476	40	9. Hale's Champion	432	40
4. White Beauty	473	..	10. Delaware	429	..
5. Cambridge Russet	473	..	11. Seedling No. 230	432	40
6. Empire State	454	40	12. Pearce's Extra Early	429	..

An average crop of 460 bushels 47 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Country Gentleman	301	24	7. Carman No. 1	274	24
2. Irish Cobbler	289	12	8. Seedling No. 7	272	48
3. New Queen	288	12	9. Lee's Favourite	270	36
4. Beauty of Hebron	286	..	10. Earliest of All	268	24
5. Brownell's Winner	281	36	11. Money Maker	266	12
6. New Variety No. 1	275	..	12. American Giant	266	12

An average crop of 278 bushels 20 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Maule's Thoroughbred..	386	36	7. Early Market..	369	36
2. Irish Daisy..	385	..	8. Columbus..	369	..
3. Early Norther..	383	18	9. Money Maker..	369	..
4. American Giant..	381	40	10. General Gordon..	367	37
5. Prolific Rose..	374	30	11. Sharpe's Seedling	367	4
6. Carman No. 1..	372	54	12. Rose No. 9..	366	51

An average crop of 374 bushels 25 lbs. per acre.

The twelve varieties of potatoes which have produced the largest crops in 1902, taking the average of the results obtained at all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Enormous..	410	14	7. Troy Seedling..	385	2
2. Irish Cobbler..	406	59	8. Hale's Champion..	384	25
3. Irish Daisy..	402	54	9. Dakota Red..	384	25
4. Money Maker..	402	29	10. Flemish Beauty..	381	33
5. Sharpe's Seedling..	389	55	11. Rose No. 9..	375	30
6. Burnaby Seedling..	387	6	12. Great Divide..	374	53

An average crop of 390 bushels 27 lbs. per acre.

The average crops of all the varieties of potatoes tested in 1902, at each of the experimental farms, were as follows :—At Ottawa, 434 bushels 38 lbs. per acre; Nappan, 381 bushels 4 lbs. ; Brandon, 333 bushels 5 lbs. ; Indian Head, 223 bushels 14 lbs., and at Agassiz, 326 bushels 24 lbs. The average return given by the whole of the varieties at all the farms was 339 bushels 22 lbs. per acre.

AVERAGE OF CROPS FOR THE PAST THREE TO EIGHT YEARS.

The results of experiments with different varieties of the more important agricultural crops to ascertain their relative productiveness become much more reliable and conclusive when the average experience of a series of years can be given. In this way variations arising from inequality of soil and variability of season are to a large extent equalized, and the conclusions reached become a much more valuable guide to the farmer in his selection of seed The longer the experiments are continued the more accurate are the indications which can be given. The experience here recorded with most of the varieties under test covers a period of from six to eight years.

THREE TO EIGHT YEARS' EXPERIENCE WITH VARIETIES OF OATS.

The twelve varieties of oats which have averaged the heaviest crops at the several experimental farms during the past three to eight years, are the following :—

(The length of time they have been under trial is stated in each case.)

In Canada the bushel of oats is 34 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. White Giant, 5 yrs..	68	..	7. Columbus, 8 yrs..	63	27
2. Banner, 8 yrs..	67	27	8. Thousand Dollar, 5 yrs..	62	24
3. Holstein Prolific, 8 yrs..	65	..	9. American Beauty, 8 yrs..	62	22
4. Mennonite, 7 yrs..	64	32	10. Golden Beauty, 8 yrs..	62	21
5. American Triumph, 8 yrs..	64	24	11. New Zealand, 4 yrs..	61	21
6. Joanette, 8 yrs..	64	8	12. Hazlett's Seizure, 8 yrs..	61	19

An average crop of 64 bushels 5 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Salines, 4 yrs..	79	14	7. Wallis, 8 yrs..	75	26
2. New Zealand, 4 yrs..	77	32	8. Milford, 4 yrs..	75	20
3. Mennonite, 7 yrs..	77	24	9. Danish Island, 5 yrs..	74	32
4. Kendal, 3 yrs..	76	29	10. Thousand Dollar, 4 yrs..	74	7
5. Siberian, 6 yrs..	76	23	11. Lincoln, 8 yrs..	74	1
6. Black Beauty, 4 yrs..	76	16	12. White Russian, 8 yrs..	73	15

An average crop of 76 bushels 3 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. American Beauty, 7 yrs..	90	5	7. White Giant, 4 yrs..	85	..
2. Banner, 7 yrs..	89	18	8. Improved American, 4 yrs.. ..	84	29
3. Mennonite, 6 yrs..	88	18	9. Early Golden Prolific, 7 yrs....	84	25
4. Bavarian, 7 yrs..	86	33	10. Holstein Prolific, 7 yrs..	83	4
5. Buckbee's Illinois, 5 yrs..	86	22	11. Golden Tartarian, 5 yrs..	83	4
6. Danish Island, 4 yrs..	85	22	12. Golden Giant, 7 yrs..	81	8

An average of 85 bushels 28 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Abundance, 7 yrs..	93	11	7. Holstein Prolific, 7 yrs	90	32
2. New Zealand, 3 yrs..	91	33	8. Siberian, 5 yrs..	89	4
3. Columbus, 7 yrs..	91	27	9. Banner, 7 yrs..	88	27
4. Danish Island, 4 yrs..	91	21	10. Wide Awake, 7 yrs..	88	24
5. Improved American, 6 yrs..	91	19	11. Golden Beauty, 7 yrs..	87	22
6. American Beauty, 7 yrs..	91	14	12. Thousand Dollar, 4 yrs..	86	12

An average crop of 90 bushels 9 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Black Beauty, 5 yrs..	76	19	7. Holland, 5 yrs..	67	26
2. Golden Tartarian, 6 yrs..	72	7	8. Banner, 8 yrs..	66	4
3. Danish Island, 5 yrs..	71	30	9. Lincoln, 8 yrs..	65	13
4. Salines, 4 yrs..	70	15	10. White Giant, 5 yrs..	64	18
5. Golden Giant, 6 yrs..	70	1	11. Buckbee's Illinois, 7 yrs..	63	29
6. New Zealand, 4 yrs..	69	8	12. Early Gothland, 8 yrs..	63	29

An average crop of 68 bushels 17 lbs. per acre.

The twelve varieties of oats which have produced the largest average crops for the past three to eight years on all the experimental farms, and hence may, perhaps, be regarded as worthy of being placed at the head of the list for general cultivation in Canada, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Banner, 8 yrs..	76	29	7. Improved American, 5 yrs	73	19
2. Danish Island, 5 yrs..	76	9	8. Black Beauty, 4 yrs..	72	32
3. Mennonite, 7 yrs..	75	19	9. Buckbee's Illinois, 7 yrs	72	20
4. American Beauty, 7 yrs	75	6	10. Columbus, 8 yrs..	72	15
5. New Zealand, 4 yrs..	75	3	11. Thousand Dollar, 5 yrs..	72	15
6. Holstein Prolific, 8 yrs..	73	26	12. Golden Giant, 8 yrs..	72	6

An average crop of 74 bushels 2 lbs. per acre.

THREE TO EIGHT YEARS' EXPERIENCE WITH VARIETIES OF BARLEY.

Two-rowed Barley.

The six varieties of two-rowed barley which have averaged the heaviest crops at the several experimental farms during the past three to eight years, are the following :—

(The length of time they have been under trial is stated in each case.)

In Canada the bushel of barley is 48 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Canadian Thorpe, 8 yrs..	46	36	4. French Chevalier, 8 yrs..	46	5
2. Danish Chevalier, 8 yrs..	46	25	5. Clifford, 4 yrs..	45	37
3. Beaver, 8 yrs..	46	16	6. Dunham, 5 yrs..	44	40

An average crop of 46 bushels 2 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Beaver, 6 yrs..	44	31	4. French Chevalier, 8 yrs..	43	41
2. Danish Chevalier, 8 yrs..	44	11	5. Clifford, 4 yrs..	43	16
3. Harvey, 4 yrs..	43	45	6. Newton, 8 yrs..	42	13

An average crop of 43 bushels 34 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Dunham, 3 yrs..	55	47	4. Harvey, 3 yrs..	48	16
2. Logan, 3 yrs..	52	27	5. French Chevalier, 6 yrs	46	25
3. Leslie, 3 yrs....	49	21	6. Sidney, 6 yrs..	45	32

An average crop of 49 bushels 36 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Danish Chevalier, 7 yrs..	57	30	4. Canadian Thorpe, 7 yrs..	53	42
2. French Chevalier, 7 yrs..	57	24	5. Prize Prolific, 7 yrs..	53	32
3. Sidney, 8 yrs....	54	42	6. Jarvis, 3 yrs..	53	29

An average crop of 55 bushels 9 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Jarvis, 4 yrs....	40	15	4. Dunham, 5 yrs..	39	14
2. Harvey, 3 yrs..	40	3	5. Kinver Chevalier, 8 yrs..	38	28
3. Canadian Thorpe, 7 yrs..	39	15	6. French Chevalier, 8 yrs..	37	30

An average crop of 39 bushels 9 lbs. per acre.

The six varieties of two-rowed barley which have produced the largest crops for the past four to eight years, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. French Chevalier, 8 yrs..	46	15	4. Jarvis, 4 yrs..	44	47
2. Clifford, 4 yrs..	45	11	5. Canadian Thorpe, 8 yrs...	44	14
3. Dunham, 5 yrs..	45	8	6. Harvey, 4 yrs..	44	1

An average crop of 45 bushels per acre.

Six-rowed Barley.

The six varieties of six-rowed barley which have averaged the heaviest crops at the several experimental farms for the past three to eight years, are the following :—

(The length of time they have been under trial is stated in each case.)

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Odessa, 8 yrs....	54	36	4. Pioneer, 8 yrs..	50	35
2. Mensury, 8 yrs..	53	42	5. Royal, 8 yrs..	50	8
3. Hulless Black, 3 yrs..	52	44	6. Stella, 8 yrs..	48	17

An average crop of 52 bushels 8 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury, 8 yrs..	52	13	4. Albert, 4 yrs..	49	38
2. Yale, 4 yrs..	51	42	5. Oderbruch, 8 yrs..	46	22
3. Garfield, 4 yrs..	50	30	6. Odessa, 8 yrs..	46	20

An average crop of 49 bushels 27 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mansfield, 3 yrs..	57	34	4. Nugent, 6 yrs..	50	15
2. Mensury, 6 yrs..	54	1	5. Summit, 6 yrs..	50	2
3. Trooper, 6 yrs..	52	25	6. Surprise, 6 yrs..	48	31

An average crop of 52 bushels 8 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Claude, 3 yrs..	67	17	4. Trooper, 7 yrs..	57	4
2. Odessa, 7 yrs..	61	44	5. Royal, 7 yrs..	56	21
3. Rennie's Improved, 7 yrs..	58	28	6. Mansfield, 4 yrs..	56	12

An average crop of 59 bushels 29 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Yale, 4 yrs....	43	36	4. Mansfield, 5 yrs..	40	..
2. Claude, 4 yrs..	43	11	5. Oderbruch, 8 yrs..	39	26
3. Albert, 4 yrs..	42	41	6. Mensury, 8 yrs	39	6

An average crop of 41 bushels 20 lbs. per acre.

The six varieties of six-rowed barley which have produced the largest crops for the past four to eight years, taking the average of the results obtained at all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury, 8 yrs..	51	28	4. Odessa, 8 yrs..	48	46
2. Claude, 4 yrs..	50	21	5. Yale, 4 yrs..	48	45
3. Mansfield, 5 yrs..	49	22	6. Trooper, 8 yrs..	47	27

An average crop of 49 bushels 23 lbs. per acre.

THREE TO EIGHT YEARS' EXPERIENCE WITH VARIETIES OF SPRING WHEAT.

The twelve varieties of spring wheat which have averaged the heaviest crops at the several experimental farms during the past three to eight years, are the following :—

(The length of time they have been under trial is stated in each case.)

In Canada the bushel of wheat is 60 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 4 yrs..	31	57	7. Wellman's Fife, 8 yrs..	27	37
2. Laurel, 4 yrs..	30	57	8. Hungarian, 7 yrs..	27	36
3. Preston, 8 yrs..	30	22	9. Pringle's Champlain, 8 yrs.. ..	27	27
4. Clyde, 4 yrs..	29	17	10. Rio Grande, 8 yrs	27	25
5. Plumper, 5 years..	28	39	11. Weldon, 4 yrs..	27	4
6. Huron, 8 yrs..	28	18	12. Colorado, 8 yrs..	27	1

An average crop of 28 bushels 38 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 4 yrs..	43	30	7. Red Swedish, 4 yrs..	36	9
2. Norval, 4 yrs....	41	10	8. Byron, 4 yrs..	35	49
3. Laurel, 4 yrs..	40	40	9. Hungarian, 7 yrs..	35	45
4. Clyde, 4 yrs..	40	10	10. Wellman's Fife, 8 yrs..	35	40
5. Weldon, 4 yrs..	37	20	11. Monarch, 7 yrs..	35	31
6. Plumper, 5 yrs..	36	24	12. White Connell, 8 yrs..	35	22

An average crop of 37 bushels 47 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 3 yrs..	45	27	7. Red Fife, 7 yrs..	36	13
2. Goose, 7 yrs....	41	21	8. Clyde, 3 yrs..	35	37
3. White Fife, 7 yrs..	37	52	9. White Connell, 7 yrs..	34	54
4. Laurel, 3 yrs..	37	13	10. Rio Grande, 7 yrs..	34	28
5. Crown, 7 yrs..	37	1	11. White Russian, 7 yrs..	34	27
6. Monarch, 7 yrs..	36	47	12. Preston, 6 yrs..	34	9

An average crop of 37 bushels 7 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 3 yrs..	46	13	7. Weldon, 3 yrs..	42	20
2. Huron, 7 yrs....	43	53	8. Red Fife, 7 yrs..	42	5
3. Preston, 7 yrs..	43	34	9. Stanley, 7 yrs..	42	3
4. Red Fern, 7 yrs..	43	30	10. Rio Grande, 7 yrs..	42	..
5. Wellman's Fife, 7 yrs..	42	43	11. Beaudry, 7 yrs..	41	53
6. Percy, 7 yrs....	42	36	12. Pringle's Champlain, 7 yrs.. ..	41	23

An average crop of 42 bushels 51 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 4 yrs..	37	5	7. Crawford, 4, yrs..	33	30
2. Red Swedish, 4 yrs..	35	57	8. Laurel, 4 yrs..	33	23
3. Early Riga, 4 yrs..	34	59	9. Colorado, 6 yrs..	33	20
4. Clyde, 4 yrs..	34	47	10. Fraser, 4 yrs..	33	4
5. Blair, 5 yrs..	34	46	11. Plumper, 5 yrs..	33	3
6. Ebert, 4 yrs..	33	43	12. Dawn, 8 yrs..	33	..

An average crop of 34 bushels 13 lbs. per acre.

The twelve varieties of spring wheat which have produced the largest crops for the past four to eight years, taking the average of the results obtained on all the experimental farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 4 yrs..	40	50	7. Huron, 8 yrs..	33	37
2. Laurel, 4 yrs..	35	32	8. Wellman's Fife, 8 yrs..	33	36
3. Preston, 8 yrs..	34	59	9. Weldon, 4 yrs..	33	36
4. Goose, 8 yrs..	34	14	10. White Fife, 8 yrs..	33	23
5. Rio Grande, 8 yrs..	33	59	11. Clyde, 4 yrs..	33	20
6. Monarch, 7 yrs..	33	55	12. Red Fife, 8 yrs..	33	16

An average crop of 34 bushels 31 lbs. per acre.

THREE TO EIGHT YEARS' EXPERIENCE WITH VARIETIES OF PEASE.

The twelve varieties of pease which have averaged the heaviest crops at the several experimental farms during the past three to eight years, are the following :—

(The length of time they have been under trial is stated in each case.)

In Canada the bushel of pease is 60 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Arthur, 7 yrs..	38	37	7. Pearl, 4 yrs	34	7
2. Canadian Beauty, 6 yrs..	36	41	8. Macoun, 6 yrs..	33	46
3. Paragon, 7 yrs..	36	5	9. Nelson, 6 yrs..	33	44
4. Kent, 6 yrs..	35	52	10. Golden Vine, 6 yrs..	33	30
5. Mackay, 7 yrs..	34	25	11. Prussian Blue, 8 yrs..	33	27
6. Duke, 7 yrs.....	34	16	12. Black-eyed Marrowfat, 7 yrs ..	33	24

An average crop of 34 bushels 49 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Crown, 7 yrs..	38	11	7. Oddfellow, 5 yrs..	31	19
2. Pride, 6 yrs..	34	10	8. Black-eyed Marrowfat, 7 yrs..	31	8
3. Early Britain, 5 yrs..	32	55	9. Nelson, 5 yrs..	31	4
4. New Potter, 7 yrs..	31	57	10. Chancellor, 5 yrs..	30	8
5. Centennial, 7 yrs..	31	55	11. Archer, 5 yrs..	29	56
6. Agnes, 6 yrs..	31	43	12. Duke, 6 yrs..	29	56

An average crop of 32 bushels 2 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Pride, 7 yrs..	45	26	7. King, 5 yrs..	42	28
2. Carleton, 6 yrs..	44	50	8. Trilby, 6 yrs..	42	8
3. Mummy, 7 yrs..	44	40	9. Crown, 6 yrs..	41	53
4. Chelsea, 3 yrs..	43	7	10. German White, 4 yrs..	41	27
5. New Potter, 7 yrs..	42	44	11. Kent, 6 yrs..	40	37
6. White Wonder, 5 yrs..	42	42	12. Prussian Blue, 5 yrs..	40	6

An average crop of 42 bushels 41 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Paragon, 6 yrs..	42	25	7. Picton, 4 yrs..	39	4
2. Crown, 6 yrs..	42	16	8. Chancellor, 5 yrs...	38	50
3. White Wonder, 5 yrs..	40	33	9. Centennial, 6 yrs..	38	33
4. Carleton, 6 years..	40	8	10. Lanark, 4 yrs..	38	27
5. Gregory, 5 yrs..	39	45	11. Pride, 6 yrs..	38	10
6. Trilby, 6 yrs..	39	40	12. Oddfellow, 5 yrs..	38	5

An average crop of 39 bushels 40 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Bruce, 4 yrs..	39	15	7. King, 6 yrs..	37	17
2. English Gray, 4 yrs..	38	35	8. Pearl, 4 yrs	37	5
3. Fergus, 5 yrs..	38	22	9. German White, 5 yrs..	37	2
4. White Wonder, 6 yrs..	38	13	10. Prussian Blue, 6 yrs	36	30
5. Gregory, 5 yrs..	38	4	11. Lanark, 5 yrs....	36	14
6. Picton, 5 yrs..	37	52	12. Early Britain, 6 yrs	36	4

An average crop of 37 bushels 33 lbs. per acre.

The twelve varieties of pease which have produced the largest crops for the past three years to seven years, taking the average of the results obtained at all the experimental farms, are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Crown, 7 yrs..	36	53	7. New Potter, 7 yrs..	34	37
2. Pride, 7 yrs..	36	6	8. Paragon, 7 yrs..	34	33
3. Carleton, 6 yrs..	35	13	9. King, 6 yrs..	34	31
4. Picton, 5 yrs..	35	9	10. White Wonder, 6 yrs..	34	28
5. Early Britain, 6 yrs..	35	7	11. Pearl, 4 yrs..	34	21
6. Chancellor, 5 yrs..	34	55	12. German White, 5 yrs..	34	19

An average crop of 35 bushels 1 lb. per acre.

THREE TO EIGHT YEARS' EXPERIENCE WITH VARIETIES OF INDIAN CORN.

The six varieties of Indian corn which have averaged the heaviest crops at the several experimental farms, during the past three to eight years, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs		Per acre. Tons.	Lbs.
1. Superior Fodder, 3 yrs..	24	593	4. Red Cob Ensilage, 3 yrs.. ..	24	162
2. Salzer's All Gold, 3 yrs..	24	583	5. Giant Prolific Ensilage, 3 yrs..	23	1,963
3. Thoro'bred White Flint, 3 yrs....	24	489	6. Selected Leaming, 7 yrs.. ..	23	303

An average crop of 24 tons 15 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Mastodon, 5 yrs..	21	1,380	4. Thoro'bred White Flint, 3 yrs..	18	1,027
2. Superior Fodder, 3 yrs..	21	1,083	5. Mammoth Cuban, 5 yrs..	18	894
3. Salzer's All Gold, 3 yrs..	19	1,000	6. Red Cob Ensilage, 3 yrs..	17	401

An average crop of 19 tons 964 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Thoro'bred White Flint, 3 yrs..	20	1,547	4. Longfellow, 3 yrs..	18	1,708
2. Early Mastodon, 5 yrs....	19	1,605	5. Champion White Pearl, 3 yrs..	18	1,320
3. Angel of Midnight, 3 yrs..	19	569	6. Salzer's All Gold, 3 yrs..	18	1,106

An average crop of 19 tons 642 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Superior Fodder, 3 yrs..	14	314	4. Early Mastodon, 5 yrs..	13	429
2. Cloud's Early Yellow, 6 yrs..	13	1,366	5. Giant Prolific Ensilage, 8 yrs ..	13	342
3. Early Butler, 6 yrs....	13	993	6. Mammoth Cuban, 5 yrs..	12	1,870

An average crop of 13 tons 866 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Butler, 6 yrs..	23	1,763	4. Cloud's Early Yellow, 6 yrs.. ..	22	568
2. Red Cob Ensilage, 8 yrs..	23	1,277	5. Superior Fodder, 3 yrs..	21	1,010
3. Early Mastodon, 5 yrs..	22	1,563	6. Pride of the North, 8 yrs.. ..	21	759

An average crop of 22 tons 1,157 lbs. per acre.

The six varieties of Indian corn which have produced the largest crops for the past three to eight years, taking the average of the results obtained on all the experimental farms, are :

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Mastodon, 5 yrs..	20	164	4. Thoro'bred White Flint, 8 yrs..	19	536
2. Salzer's All Gold, 3 yrs..	19	1,795	5. Red Cob Ensilage, 8 yrs..	19	53
3. Superior Fodder, 3 yrs..	19	1,630	6. Early Butler, 6 yrs..	18	1,143

An average crop of 19 tons 887 lbs. per acre.

THREE TO EIGHT YEARS' EXPERIENCE WITH VARIETIES OF TURNIPS.

The six varieties of turnips which have averaged the heaviest crops at the several experimental farms, during the past three to eight years, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Magnum Bonum, 3 yrs..	38	1,223	4. Carter's Elephant, 8 yrs..	36	641
2. Elephant's Master, 3 yrs..	36	1,742	5. Drummond Purple Top, 5 yrs..	36	336
3. Purple Top Swede, 8 yrs..	36	720	6. Imperial Swede, 4 yrs..	35	1,610

An average crop of 36 tons 1,379 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Kangaroo, 3 yrs..	39	1,585	4. Elephant's Master, 3 yrs..	39	375
2. Selected Champion, 3 yrs..	39	1,035	5. New Arctic, 4 yrs..	37	1,116
3. Imperial Swede, 4 yrs..	39	979	6. Monarch, 4 yrs..	37	415

An average crop of 38 tons 1,584 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Perfection Swede, 7 yrs..	23	973	4. Purple Top Swede, 8 yrs..	22	1,705
2. Skirvings, 8 yrs..	23	74	5. Hall's Westbury, 6 yrs	22	517
3. Prize Winner, 7 yrs..	23	16	6. Mammoth Clyde, 7 yrs....	22	153

An average crop of 22 tons 1,573 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Webb's New Renown, 4 yrs..	23	647	4. Halewood's Bronze Top, 6 yrs.	21	1,062
2. Perfection Swede, 7 yrs..	22	333	5. Monarch, 4 yrs..	21	954
3. Drummond Purple Top, 5 yrs.. ..	21	1,094	6. Purple Top Swede, 8 yrs	21	670

An average crop of 21 tons 1,793 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Bangholm Selected, 6 yrs..	41	1,299	4. Halewood's Bronze Top, 6 yrs..	39	477
2. Perfection Swede, 7 yrs..	39	1,164	5. Hall's Westbury, 6 yrs..	38	1,297
3. Purple Top Swede, 8 yrs..	39	852	6. Jumbo, 8 yrs..	38	177

An average crop of 39 tons 544 lbs. per acre.

The six varieties of turnips which have produced the largest crops for the past four to eight years, taking the average of the results obtained at all the experimental farms, are :

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Perfection Swede, 7 yrs..	31	794	4. Halewood's Bronze Top, 6 yrs..	30	1,015
2. Imperial Swede, 4 yrs..	30	1,734	5. Hall's Westbury, 6 yrs	30	719
3. Purple Top Swede, 8 yrs..	30	1,530	6. Bangholm Selected, 6 yrs.. ..	29	1,812

An average crop of 30 tons 1,267 lbs. per acre.

THREE TO SEVEN YEARS' EXPERIENCE WITH VARIETIES OF MANGELS.

The six varieties of mangels which have averaged the heaviest crops at the several experimental farms, during the past three to seven years, are the following:—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Prize Winner Yellow Globe, 3 yrs.	43	1340	4. Half Long Sugar Rosy, 3 yrs..	40	128
2. Half Long Sugar White, 3 yrs....	40	575	5. Gate Post, 7 yrs..	39	1,655
3. Lion Yellow Intermediate, 4 yrs..	40	452	6. Mammoth Long Red, 7 yrs.. ..	39	1,153

An average crop of 40 tons 1,217 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Prize Winner Yellow Globe, 3 yrs.	39	1,475	4. Giant Yellow Intermediate, 7 yrs	35	1,449
2. Lion Yellow Intermediate, 4 yrs..	38	1,516	5. Half-Long Sugar White, 3 yrs..	34	585
3. Mamm. Yellow Intermediate, 5 yrs.	36	1,271	6. Giant Yellow Half Long..	34	525

An average crop of 36 tons 1,137 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Selected Mamm. Long Red, 6 yrs..	32	1,926	4. Prize Mamm. Long Red, 7 yrs..	30	607
2. Yellow Intermediate, 7 yrs..	31	948	5. Gate Post, 7 yrs..	30	596
3. Giant Yellow Intermediate, 7 yrs.	31	426	6. Mamm. Long Red, 7 yrs..	29	1,691

An average crop of 31 tons 32 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant Yellow Half Long, 6 yrs..	21	1,758	4. Ward's Large Oval-shaped, 6 yrs	21	442
2. Yellow Intermediate, 7 yrs..	21	1,552	5. Champion Yellow Globe, 7 yrs..	21	403
3. Selected Mamm. Long Red, 6 yrs.	21	1,087	6. Gate Post, 7 yrs..	21	153

An average crop of 21 tons 899 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Yellow Intermediate, 7 yrs..	36	468	4. Selected Mamm. Long Red, 6 yrs	33	165
2. Giant Yellow Intermediate, 7 yrs.	34	959	5. Canadian Giant, 7 yrs..	31	1,956
3. Lion Yellow Intermediate, 4 yrs.	33	1,790	6. Mam. Yellow Intermediate, 4 yrs	31	1,310

An average crop of 33 tons 1,108 lbs. per acre.

The six varieties of mangels which have produced the largest crops for the past three or seven years, taking the average of the results obtained at all the experimental farms, are :

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Yellow Intermediate, 7 yrs.. ..	32	577	4. Gate Post, 7 yrs..	30	1,984
2. Giant Yellow Intermediate, 7 yrs.	31	1,463	5. Selected Mamm. Long Red, 6 yrs	30	847
3. Lion Yellow Intermediate, 4 yrs.	31	237	6. Mammoth Long Red, 7 yrs....	30	643

An average crop of 31 tons 292 lbs. per acre.

THREE TO SEVEN YEARS' EXPERIENCE WITH VARIETIES OF CARROTS.

The six varieties of carrots which have averaged the heaviest crops at the several experimental farms, during the past three to seven years, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate, 4 yrs..	35	1,363	4. Half Long White, 7 yrs..	30	279
2. Giant White Vosges, 7 yrs.. ..	30	1,927	5. Improved Short White, 7 yrs ..	29	1,604
3. Mamm. White Intermediate, 7 yrs.	30	1,380	6. Iverson's Champion, 7 yrs.. ..	29	1,541

An average crop of 31 tons 349 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate, 4 yrs.	23	1,344	4. Giant White Vosges, 7 yrs.. ..	21	1,080
2. Mamm. White Intermediate, 7 yrs.	22	297	5. Ontario Champion, 5 yrs..	21	741
3. Half Long White, 7 yrs..	21	1,481	6. Green Top White Orthe, 6 yrs..	20	1,961

An average crop of 21 tons 1,901 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mamm, White Intermediate, 7 yrs.	18	855	4. Ontario Champion, 5 yrs..	13	1,456
2. Long Yellow Stump Rooted, 3 yrs.	14	1,407	5. Giant White Vosges, 7 yrs.. ..	13	1,311
3. New White Intermediate, 4 yrs..	14	1,150	6. Half Long White, 7 yrs..	13	1,060

An average crop of 14 tons 1,540 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate, 3 yrs..	14	1,856	4. White Vosges Large Short, 3 yrs	12	1,194
2. Long Yellow Stump Rooted, 3 yrs.	13	861	5. Iverson's Champion, 7 yrs.. ..	12	700
3. Ontario Champion, 5 yrs..	13	809	6. Half Long White, 7 yrs..	12	94

An average crop of 13 tons 252 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Impróved Short White, 7 yrs.. ..	34	993	4. Half Long White, 7 yrs..	31	505
2. Giant White Vosges, 7 yrs..	33	1,769	5. New White Intermediate, 4 yrs.	31	495
3. Green Top White Orthe, 5 yrs.. ..	31	642	6. Ontario Champion, 4 yrs..	30	1,512

An average crop of 32 tons 319 lbs. per acre.

The six varieties of carrots which have produced the largest crops for the past four to seven years, taking the average of the results obtained at all the experimental farms, are :

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate, 4 yrs ..	24	142	4. Improved Short White, 7 yrs ..	21	1,163
2. Giant White Vosges, 7 yrs.....	22	359	5. Ontario Champion, 5 yrs.... ..	21	1,122
3. Half Long White, 7 yrs..	21	1,484	6. Mam.White Intermediate, 7 yrs	21	835

An average crop of 22 tons 184 lbs. per acre.

FOUR TO SIX YEARS' EXPERIENCE WITH VARIETIES OF SUGAR BEETS.

The four varieties of sugar beets which have averaged the heaviest crops at the several experimental farms during the past four to six years, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Improved, 6 yrs..	28	1,759	3. Improved Imperial, 6 yrs..	27	588
2. Danish Red Top, 5 yrs..	27	1,341	4. Red Top Sugar, 6 yrs..	26	1,240

An average crop of 27 tons 1,232 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Top Sugar, 6 yrs..	28	22	3. Improved Imperial, 6 yrs.... ..	26	1,211
2. Danish Red Top, 5 yrs..	27	695	4. Danish Improved, 6 yrs	25	1,353

An average crop of 26 tons 1,820 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top, 5 yrs..	27	1,849	3. Red Top Sugar, 6 yrs..	23	510
2. Danish Improved, 6 yrs..	24	1,071	4. Wanzleben, 6 yrs..	22	1,836

An average crop of 24 tons 1,311 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top, 5 yrs..	17	420	3. Danish Improved, 6 yrs	14	793
2. Red Top Sugar, 6 yrs..	15	872	4. Improved Imperial, 6 yrs..	14	678

An average crop of 15 tons 691 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top, 4 yrs..	28	1,849	3. Improved Imperial, 5 yrs..	23	116
2. Danish Improved, 5 yrs..	24	195	4. Red Top Sugar, 5 yrs..	22	1,216

An average crop of 24 tons 1,344 lbs. per acre.

The four varieties of sugar beets which have produced the largest crops for the past five to six years, taking the average of the results obtained at all the experimental farms, are :

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top, 5 yrs..	25	1,631	3. Red Top Sugar, 6 yrs..	23	372
2. Danish Improved, 6 yrs..	23	1,034	4. Improved Imperial, 6 yrs..	22	496

An average crop of 23 tons 1,383 lbs. per acre.

THREE TO EIGHT YEARS' EXPERIENCE WITH VARIETIES OF POTATOES.

The twelve varieties of potatoes which have averaged the heaviest crops at the several experimental farms during the past three to eight years, are the following. The length of time which they have been under trial is stated in each case :—

In Canada the bushel of potatoes is 60 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Swiss Snow Flake, 3 yrs..	452	28	7. McIntyre, 3 yrs..	409	12
2. Late Puritan, 8 yrs..	431	59	8. Country Gentleman, 4 yrs.. ..	403	4
3. American Wonder, 8 yrs..	430	29	9. Uncle Sam, 5 yrs..	402	36
4. Seattle, 8 yrs..	428	8	10. Flemish Beauty, 8 yrs..	397	56
5. Holborn Abundance, 8 yrs..	426	28	11. Burnaby Seedling, 8 yrs..	391	49
6. Penn Manor, 4 yrs..	411	24	12. Reeves' Rose, 6 yrs..	391	5

An average crop of 414 bushels 43 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Irish Daisy, 8 yrs..	436	18	7. Pearce's Prize Winner, 7 yrs..	396	26
2. Seedling No. 230, 7 yrs... .. .	434	48	8. Irish Cobbler, 6 yrs..	393	55
3. Holborn Abundance, 8 yrs.. ..	422	13	9. Pride of the Market, 8 yrs.	387	58
4. Seattle, 7 yrs..	419	59	10. Seedling No. 7, 6 yrs..	385	40
5. Hale's Champion, 7 yrs..	399	59	11. Bill Nye, 6 yrs..	384	40
6. American Giant, 6 yrs..	399	8	12. Carman No. 1, 8 yrs..	383	48

An average crop of 403 bushels 44 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Maule's Thoroughbred, 5 yrs....	407	..	7. Great Divide, 8 yrs..	378	35
2. Seedling No. 7, 6 yrs..	405	47	8. Burnaby Seedling, 7 yrs	377	2
3. Delaware, 7 yrs..	398	..	9. Empire State, 7 yrs..	376	..
4. American Wonder, 6 yrs..	389	53	10. Carman No. 1, 8 yrs..	374	27
5. Irish Daisy, 7 yrs..	388	40	11. I. X. L., 8 yrs..	374	27
6. State of Maine, 8 yrs..	388	26	12. Hale's Champion, 7 yrs..	372	41

An average crop of 385 bushels 55 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. American Giant, 7 yrs..	462	10	7. New Variety, No. 1, 7 yrs.. ..	413	3
2. Uncle Sam, 6 yrs..	449	40	8. Rochester Rose, 7 yrs.. .. .	402	7
3. Bovee, 5 yrs..	444	43	9. General Gordon, 6 yrs..	399	50
4. Carman No. 3, 6 yrs..	440	10	10. Northern Spy, 8 yrs..	395	3
5. Country Gentleman, 3 yrs.. ..	435	41	11. Lee's Favourite, 7 yrs..	394	40
6. American Wonder, 8 yrs..	429	10	12. Carman No. 1, 8 yrs..	392	3

An average crop of 421 bushels 32 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Uncle Sam, 5 yrs..	438	51	7. Seedling No. 7, 7 yrs..	389	..
2. Rose No. 9, 6 yrs..	414	33	8. Bovee, 5 yrs..	382	23
3. McIntyre, 3 yrs..	408	47	9. Clay Rose, 8 yrs..	380	9
4. Swiss Snow Flake, 3 yrs..	405	50	10. Houlton Rose, 6 yrs..	379	59
5. Dakota Red, 8 yrs	399	18	11. Vick's Extra Early, 6 yrs.. ..	374	43
6. Seedling No. 230, 7 yrs....	392	13	12. Brown's Rot Proof, 6 yrs..	372	43

An average crop of 395 bushels per acre.

The twelve varieties of potatoes which have produced the largest crops, taking the average of the results obtained on all the experimental farms for the past three to eight years are :

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Uncle Sam, 3 yrs..	391	22	7. Bovee, 5 yrs..	370	10
2. Irish Daisy, 7 yrs..	387	2	8. Country Gentleman, 4 yrs.. ..	369	6
3. Seedling No. 7, 6 yrs..	384	20	9. Rose No. 9, 6 yrs..	369	..
4. American Wonder, 8 yrs..	382	12	10. Late Puritan, 8 yrs..	368	28
5. American Giant, 7 yrs..	379	50	11. Carman No. 1, 8 yrs..	366	53
6. Seedling No. 230, 7 yrs..	379	45	12. Seattle, 7 yrs..	364	53

An average crop of 376 bushels 5 lbs. per acre.

CONCLUSIONS.

The experience of another year with comparative trial plots of many different varieties of grain, fodder corn, field roots and potatoes affords striking confirmation of the correctness of the results and conclusions which have been reached from season to season for the past eight years from the study of this interesting and important series of experiments.

The evidence produced shows that there are great differences in the relative productiveness of varieties, when grown side by side under similar conditions, hence the importance to farmers of choosing for seed those which give the heaviest crops, so that farming in Canada may thus be made more profitable.

In bulletin No. 40, published a year ago, in which was given the results of similar trial plots for 1901, no varieties of grain were admitted into the comparative list for a series of years unless they had been under trial for five or more years. Under this arrangement only 41 of the 64 sorts under test were considered. In this issue all those which have been three years or longer under trial are placed in competition, and the number of years they have been under test is stated in each case. As a result of this new arrangement some of the more promising of the more recently introduced sorts have found their way into the list of the 12 varieties which have given the largest crops throughout the Dominion. It is noteworthy, however, that in most instances the larger number in these lists consists of varieties which have been under trial for seven or eight years, and these are for the most part the same sorts as appeared among the best twelve in 1901 and previous years.

The general adoption of this plan throughout the bulletin has brought new names into most of the groups, but the preponderance maintained by the most productive sorts of past years shows the persistence of their productive character.

Having gained much experience during the past eight years with the many varieties under trial, it is proposed during the coming season to reduce the number of sorts being tested by discontinuing those which have failed to attain to a desirable standard and retaining only the very best in each series. By this means the names of those sorts which long experience has shown to be the most profitable to grow will be brought more prominently into notice, thus permitting a more ready selection of varieties of the highest excellence.

S
133
.E22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

June 18 .03

THE RAPE PLANT

(*Brassica napus*, Linn.)

ITS CULTURE, USE AND VALUE

BY

J. H. GRISDALE, B. Agr.
Agriculturist of the Central Experimental Farm

BULLETIN No. 42

MAY, 1903

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE

To the Honourable
The Minister of Agriculture.

SIR,—I have the honour to submit for your approval, Bulletin No. 42, which has been prepared by Mr. J. H. Grisdale, Agriculturist of the Central Experimental Farm.

In this bulletin the cultivation, use and value of the Rape plant is discussed and its usefulness for forage purposes for most classes of stock demonstrated. The best methods of cultivation are submitted, also the cost of growing this crop. Some particulars are also given as to the results obtained at the Central Experimental Farm in the feeding of this plant to swine and steers.

It is hoped that the information given in this bulletin will be useful to farmers and stockmen throughout the country.

I have the honour to be,
Your obedient servant,

WM. SAUNDERS,
Director Experimental Farms.

OTTAWA, May 20th, 1903.

RAPE

(*Brassica napus*, Linn.)

THE RAPE PLANT, ITS CULTURE, USE AND VALUE

By J. H. GRISDALE, B. Agr., Agriculturist.

Among all forage plants possible and profitable of cultivation in Canada none seems worthier of a more extensive use than rape. It is simple of culture; it makes a strong, rapid growth; it adapts itself quite readily to different soils and to various climatic conditions; it responds vigorously to fertilizer and to good cultivation; and, most important of all its good qualities, it is a palatable, wholesome and nutritious green food for all kinds of live stock on the average Canadian farm.

The Plant.

Rape stems and leaves resemble those of Swedish turnips or ruta-bagas, but the roots are like those of cabbage. The leaves are numerous, smooth, more or less fleshy, irregular in outline and covered with a fine bluish bloom. The plant grows to a height of from one to four feet, according to soil and season.

Varieties.

The variety most commonly used in Canada is the Dwarf Essex. Several other sorts, most notably Dwarf Victoria and Broad Leaved, have been brought forward, but have not, on trial, been found to equal the Dwarf Essex in yield or in power of resistance to drought or flood.

Seed.

The varieties used as forage plants are biennial, but do not, generally speaking, live through the winter in Canada, unless it be in certain parts of British Columbia. Seed, therefore, is imported and is generally good. Occasionally, however, seed of the annual variety, or Bird Seed Rape, is sold in the place of the Dwarf Essex or other biennial sorts, causing considerable loss to the stockman. The seedsman from whom the rape seed is secured should, therefore, be required to guarantee it as being that of Dwarf Essex.

Suitable Soils.

Rape in the farm economy may be classed with root or hoed crops. It will grow on almost any kind of arable land. It does best, however, on soils rich in plant food and full of humus or vegetable matter. It should, therefore, be sown on fields prepared as they would be for roots or corn. Sod, to give a good crop of rape, must be left to rot for some time after ploughing before sowing rape. It should be harrowed at frequent intervals and the field be in a state of perfect tilth when seeded. New land may be most profitably used to grow this crop for a year or two immediately after being cleared. Large crops of rape are practically certain on such land, and stumps or roots interfere but slightly with the harvesting.

Black soil or muck gives good returns when put under rape and may be expected to give better returns with rape than with most other crops.

Time of Seeding.

The seeding season extends from the first week in May till the end of August, subject, of course, to local climatic conditions. The crop, growing under favourable weather and soil conditions, may be fit for pasture in about five weeks. From this fact the stockman can decide for himself how late he may venture to sow in any given district in order to ensure a sufficiently long feeding period to make it worth while. The plant will stand a quite heavy frost without suffering appreciable injury.

Methods of Seeding.

Broadcast.—Rape may be sown broadcast or in rows. Where intended to be used for soiling, a thin broadcast seeding may be expected to give satisfaction. The quantity of seed required per acre when sown broadcast is about four pounds. A larger quantity of seed may be used when it is intended to cut as soon after seeding as possible; a lesser quantity where it is intended to permit the plants to attain their full growth. The leaves and small stems are the most nutritious and palatable parts of the plant, hence the above conditions of seeding.

When cutting for soiling, care should be taken to cut not lower than four or four and a half inches from the ground. By observing this precaution, a second, and even a third, crop may be expected from the same area without any further seeding.

Rows.

Where sown in rows, less than 4 pounds per acre may be used. The quantity is, of course, affected by the space between the rows. Anywhere from 20 to 30 inch spaces give more or less satisfaction, but 22 inch spaces are probably the most profitable. Less space than 22 inches makes horse cultivation inconvenient; greater space means a slight decrease in the yield per acre. In dry soils or droughty areas, level culture should be practised; in badly drained fields or rainy districts, it is advisable to sow on ridges.

The method of seeding in rows is, generally speaking, much to be preferred over the broadcast. The principal reasons for such preference are: (1) greater proportion of leaf to stem, (2) more rapid and vigorous growth, (3) less waste when pastured, as animals naturally walk between rows and do not, therefore, trample so many leaves or plants as when sown broadcast, and (4) permits of cultivation, which insures conservation of moisture in dry seasons, and destruction of weeds in wet times.

As a Catch Crop.

Rape is sometimes mixed with grain and sown in the spring. It makes a slow growth till harvest time, when after the removal of the grain it rapidly shoots up. This is a rather uncertain method and more or less objectionable when it does succeed, on account of the amount of it harvested with the grain, and so retarding the curing of the sheaves.

Clover will, generally speaking, do better than rape under such conditions.

Rape is sometimes sown in cornfields just before the last cultivation. The results are seldom satisfactory, however, as the corn takes nearly all the available moisture and sunlight.

Uses of the Crop.

As already indicated, rape is an exceedingly valuable food. It is especially well fitted for sheep, swine, young cattle, and steers. It has been fed to dairy cows with good results.

Sheep on Rape.—Breeding ewes do well on it in summer, and it constitutes a capital feed for "flushing" or putting them into good condition for breeding in the fall. Lambs thrive upon it, but in their case it is possibly even more imperative than with older sheep or cattle to provide some other pasture (preferably other than clover) in addition to the rape.

Pasture for Pigs.—It makes a very good pasture for brood sows. A little corn or barley fed in conjunction helps to balance the ration.

For fattening and growing pigs it cannot be surpassed. They sometimes need to be trained to eat it, but once taught they consume it most freely. An acre sown on good land and handled carefully may be expected to carry from 25 to 40 pigs from June 15 to October. The exact number an acre will carry depends upon the season, the soil, and the method of handling. To get the best results, the field should be divided into three or four equal parts and the pigs changed over to a fresh part each week or ten days.

Soiling Pigs.—Of course, greater returns in pounds of pork produced may be secured by cutting the rape and feeding it to pigs in pens, but more labour is required and so, in a measure at least, the advantage is lost.

Young cattle and steers.—Calves relish a small amount of rape at a very early age and do well on it when fed judiciously. Young cattle thrive on it when it is fed in connection with natural grass pasture. Steers intended for stall feeding or late fall marketing cannot be better cared for than to be allowed the run of a good field of rape.

Dairy cows.—Dairy cows respond well to a rape ration, but judgment must be exercised in feeding or evil odours may find their way into the milk pail.

Dangers.

In feeding rape to cattle and sheep care should be taken to prevent bloating. They should never be allowed to enter a rape field when very hungry, more especially should this precaution be observed if the rape is wet from dew, rain, or frost. Once accustomed to the feed, however, and having access to it at all times, little danger may be anticipated. Pigs are not affected in this way.

Harvesting.

On account of its very juicy nature, it is practically impossible to cure rape, and when cured it is not so palatable nor so valuable a food as when green. It is not much used in making ensilage.

In sections where rather steady frost maintains (once the hard frosts come) rape may be cut and put in small piles to freeze. It should be taken to the stable the day before required for feed and allowed to thaw out completely before being fed. Repeated thawing and freezing spoil it for forage.

Composition.

In chemical composition and feeding value rape resembles clover. It is even richer than clover in flesh forming constituents, and is exceedingly succulent. Analyses show its water-content to run from about 89 to about 94 per cent. The nutritive ratio or proportion of digestible protein (flesh-forming constituents) to digestible carbohydrates and fats (heat producing constituents) is about 1 to 3·37. Such a large proportion of digestible protein accounts for the great feeding value of the plant. Then, since average, growing animals require a ration of a nutritive ratio of about 1 to 5·5, it is easily seen why most animals require some other food not so rich in protein, along with rape. Timothy or a mixed grass pasture would be suitable for this purpose.

Cost to Produce Rape at Ottawa.

One Acre.

Ploughing in spring	$ 2 00
Harrowing (4 times) team, 3 hours	75
Rolling, ¾ hour	20
Seed, 3 lbs. at 8c	24
Sowing, 3 hours at 13⅓c	40
Hand wheel hoeing, once, 4 hours	53
Cultivating, 3 times, single horse, ¾ day at $2	1 50
Hoeing, once, 1 day	1 33
	$6 95

If the rent of land be considered and any commercial fertilizer or barnyard manure, be applied, the cost of production would of course be increased. As already indicated, however, barnyard manure may be most profitably applied to land used for this crop.

Results from Feeding Rape at Ottawa.

Lambs and sheep have been fed with most excellent results. No exact record was kept of the amount consumed, however, as they were pastured.

Steers have been pastured here on rape and good results secured. A bunch of 22 steers made an average of 50 lbs. gain, live weight, in 3 weeks on an area of 2 acres. About 30 sheep had been allowed to pasture on part of this same area for 10 weeks. The sheep had had at the same time access to a limited area of natural grass pasture.

Experiments with Pigs.

A great many pigs are fed annually on rape on the Experimental Farm at Ottawa. The following record is submitted to illustrate the part taken by rape in pork production, in one instance six pigs were pastured from August 14th till snow in 1900 on three-sixteenths of an acre of rape.

LOT OF SIX PIGS ON RAPE PASTURE.

No. of Pig.	Weights.							
	Aug. 14.	Aug. 28.	Sept. 11.	Sept. 25.	Oct. 9.	Oct. 16.	Oct. 30.	Dec. 6.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
279	61	76	80	85	96	108	129	175
280	60	73	80	95	105	121	147	195
281	64	73	91	103	111	127	150	201
282	60	73	90	99	109	120	143	171
283	60	72	82	99	114	135	157	203
284	53	68	76	90	105	118	141	182
Total	358	435	499	571	640	729	867	1,127
Total gain	.....	87	64	72	69	89	138	260
Daily rate of gain in lbs.	.....	1·03	0·76	0·85	0·82	2·12	1·64	1·20
Daily grain ration	.....	1	1½	1¾	2	3	4	5

During the latter part of November and December the pigs had no rape.

A study of the above table shows that to produce 100 pounds of pork, only 269 pounds of meal was required in addition to the rape. The average amount of meal required for 100 pounds of pork is 425 pounds. The use of rape, therefore, saved 156 pounds of meal on each 100 pounds of pork produced, or about 1,210 pounds of meal saved by three-sixteenths of an acre of rape. All pig weights mentioned are live weight.

Many other lots have been fed similarly with similar results. In 1902 60 pigs were fed on an acre and a-half. In addition to the rape pasture, about 500 pounds of meal were required for each pig from weaning time to an average of 185 pounds live weight in October or November.

S
133
.E22

DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

EXPERIMENTAL FARMS

UNIV. OF MICHIGAN

PLUM CULTURE

AND

DISTRICT LISTS OF PLUMS SUITABLE FOR CANADA

WITH

DESCRIPTIONS OF VARIETIES

BY

W. T. MACOUN,

Dominion Horticulturist, Central Experimental Farm.

BULLETIN No. 43

(REVISED EDITION)

1918

Published by direction of the Hon. MARTIN BURRELL, Minister of Agriculture, Ottawa, O.

To the Honourable
The Minister of Agriculture.

SIR,—I beg to submit for your approval Bulletin No. 43 of the Experimental Farm series which has been revised under my direction by Mr. W. T. Macoun, Dominion Horticulturist.

The subject treated of is Plum Culture and the information presented has been largely derived from the experience gained in connection with plum growing at the Central Experimental Farm during the past twenty-five years. In this bulletin information is given as to the best methods of preparing the soil for a plum orchard, with particulars also as to the planting and subsequent care of the trees. Instructions are also given as to methods of pruning, grafting and on many other topics relating to this branch of fruit industry. Lists of varieties of plums suitable for planting in different parts of Canada are given with descriptions as to the character, quality and time of ripening of each sort. Some of the insects and diseases to which the plum is subject are also referred to and methods of treatment suggested. A chapter has been prepared by Mr. F. T. Shutt, Dominion Chemist, on fertilizers for the plum orchard.

It is hoped that the information submitted will be useful to those interested in the cultivation of this fruit in Canada, that it will prove a stimulus to the further planting of plums and that it may aid in making the growing of this useful fruit more successful and more profitable in this country.

I have the honour to be, sir,
Your obedient servant,

J. H. GRISDALE,
Director Dominion Experimental Farms.

Ottawa, August 29, 1913.

TABLE OF CONTENTS.

	Page.
Classification of plums	7
European plums	7, 33
Japanese plums	9, 40
Americana plums	10, 40
Nigra plums	48
Hybrid plums	11, 48
Culture in different provinces of Canada	12
Experiments with plums at the Central Experimental Farm	13
Seedling varieties	14
Cross-breeding	15
Propagation	15
Stocks	15
Budding	16
Grafting	18
Material needed in grafting and budding	21
Grafting wax	22
The nursery	22
The orchard	23
Soil and exposure	23
Preparation of land	23
Laying out of the orchard	25
Windbreaks	25
Kind of trees to plant	26
Planting	26
Varieties	27
Varieties for the different provinces of Canada	28
Description of varieties	32
European varieties	32
Japanese varieties	40
Americana varieties	40
Nigra varieties	48
Hybrid varieties	48
Varieties of plums being tested at the Central Experimental Farm	51
Pollination of plums	53
Season of blooming of Americana and Nigra plums	57

48069—2

PAGE.

Pruning.. 57
Fertilizers for the plum orchard.. 57
Cultivation.. 59
Cover crops.. 59
Picking, packing, storing and marketing the fruit.. 60
Thinning the fruit.. 60
Prunes.. 61
Canning and preserving American plums.. 61
Spraying.. 64
Diseases of the plum.. 65
Insects most injurious to the plum.. . . . . .68, 71
Insecticides and fungicides.. 69

PLUM CULTURE

BY

W. T. MACOUN,

Dominion Horticulturist.

If every member of every family in Canada had a plentiful supply of plums of the best quality for home use, and if enough of the fruit were exported profitably from Canada to supply the demands of the people of other lands there would be less necessity for publishing a bulletin on Plum Culture; but unfortunately this is far from being the case. Comparatively few people get good plums to eat, especially in the fresh condition, and the export trade in plums, whatever it may be in the future, is practically nothing at the present time.

Past experience has been that the consumption of fruit increases almost, or quite, as rapidly as the supply, providing the latter is properly distributed, and it is not too much to expect that it will do so in the future, at least for some time. The desire for fruit grows on the consumer, and the better the quality of the fruit supplied the greater will be the desire for it.

The plum has not been as profitable to grow in Canada as some other fruits, but with a careful selection of varieties and good care it will be found to give fairly good returns. In those parts of Canada where the European plums do not succeed, the improved native and American varieties have been found very profitable. Some of these ripen before the European plums come on the market and they sell at high prices.

In preparing this bulletin, it has been necessary to correspond with many fruit growers in Canada to obtain accurate information in regard to plum culture in different parts of the Dominion. This, with the knowledge gained from experience at the Central Experimental Farm, has enabled the writer to make this bulletin much more useful than it otherwise would be.

CLASSIFICATION OF PLUMS.

There are five species of plums from which are derived most of the cultivated varieties of to-day, namely, the European, derived from *Prunus domestica, Prunus insititia,* and *Prunus carasifera*; the Japanese, from *Prunus triflora*; and the American, from *Prunus americana, Prunus nigra,* and *Prunus hortulana.* A Chinese species, *Prunus Simonii,* has given at least one variety and has been used extensively in cross-breeding, and the so-called Western Sand Cherry, *Prunus pumila Besseyi,* a native of North America, has also been used as a parent in plum breeding.

EUROPEAN PLUMS.

This class of plum has reached a higher stage of development than either the Japanese or American, which is due to the fact that they have been under cultivation from very early times and that more systematic and intelligent labour has been spent on their improvement. It is thought by some authorities that the European plums have gradually developed from the Damson, and that the latter originated

48069—2½

from the European sloe, *Prunus spinosa.* The Damsons, however, are so distinct in tree and fruit from other European plums that other authorities have a separate group of them. There is such a wide difference between the Damson and the Reine Claude or Green Gage groups that it seems reasonable to suppose that the origin of the two was different, and indeed they have been regarded as different types, at least since the Middle Ages. Both the Damsons and the Green Gages come fairly true from seed. The following classification is the same as that given in the 'Plums of New York' (Hedrick) and 'Plums and Plum Culture' (Waugh):

Yellow Egg type.—This includes some of the largest European plums and is represented by Yellow Egg, Golden Drop, and Grand Duke.

Perdrigon type.—The only variety of this type which is grown in Canada, to the writer's knowledge, is the French Red Perdrigon, introduced by the Trappist Fathers, Oka, Que.

Diamond type.—(Waugh), Imperatrice type (Hedrick).—This includes some of the most productive, firmest and best shipping varieties but usually those of only medium quality. Varieties of this type are Diamond, Kingston, Quackenboss, Glass, Shipper, Mount Royal, and Arctic. Archduke and Grand Duke, while differing considerably from the type, might be put here.

Bradshaw type.—Under this type, Professor Waugh includes Bradshaw, Victoria, Pond, Field, Duane Purple, Oswego and Giant Prune. These varieties, however, have not as many characteristics in common as those of the previous types. In the 'Plums of New York' they are included in the next.

Lombard type.—Represented by Lombard, Communia, Vorenesh 20 of Budd, Leipsic of Budd, Prince of Wales and Merunka. The early Red Russian and White Nicholas of Budd would also be included in this type.

Prune Group.—Represented by Italian Prune (Fellenberg), German Prune, Raynes, Agen, and Ungarish.

Damson Group.—In this are the Damson type and Mirabelle type.

Damson type.—The best known varieties of this type are Shropshire, French, Frogmore and Cluster.

Mirabelle type.—The varieties grown in Canada are Mirabelle précoce and Mirabelle tardive.

Reine Claude or Green Gage Group.—There is a large number of fine dessert varieties in this group, the principal being Reine Claude, Green Gage, Lawrence, Imperial Gage, McLaughlin, Jefferson, Washington, General Hand, Bleeker, Peter's Gage and Queen May.

Plums of the European class succeed best in Ontario in the counties bordering on the great waterway southward and eastward from the Georgian Bay to the Thousand Islands. They may be grown very successfully all through south-western Ontario and the Niagara peninsula, and through the central counties to those bordering on Lake Huron. East of Toronto the best varieties are grown within twenty-five or thirty miles of Lake Ontario. North and east of these areas, only the hardiest kinds succeed well, and but very few are hardy north of latitude 45°.

In the province of Quebec, a few varieties give fair satisfaction in the Eastern Townships and a few on the Island of Montreal, and along the Ottawa river above Montreal, past the Lake of the Two Mountains. Along the south shore of the St. Law-

rence river, below the city of Quebec, in the counties of Levis, Bellechasse, Montmagny, L'Islet, Beauce, Kamouraska and Temiscouata, most of the finest varieties of European plums can be grown with good success, and along the north shore in the counties of Portneuf, Quebec (Island of Orleans, especially), and Charlevoix, some of the hardiest sorts succeed. It is, however, near the river, and where its influence is felt, that these plums succeed best.

On Prince Edward Island, the European plums do well; also in many parts of Nova Scotia, and they do particularly well in the southern part of that province. In New Brunswick, some of the varieties succeed in the warmer parts of the province, particularly along the Lower St. John river and near the south coast.

The European plums do exceptionally well on Vancouver Island and the Lower Mainland of British Columbia, and also in the Okanagan, Kootenay and other valleys, and no doubt in many of the northern valleys of that province with temperate climates, where they have not been fully tested yet, they will be found to succeed.

In the Prairie provinces, the European plums have not been found sufficiently hardy, the trees being winter-killed.

The hardiness of the European plum appears to be governed partly by the moisture of the atmosphere, and partly by the temperature. At Ottawa, very few varieties will fruit at all, and most of these bear a good crop only once in three or four years. It is not the wood which is killed by winter, although winter-killing of the tips does occur when the temperatures are very low, but the flower buds are destroyed. This killing of the buds appears to be due partly to the dry, cold weather of winter, and partly to spring frosts. Good crops of European plums have been produced at Ottawa after the temperature had been lower than 20° Fahr. below zero the previous winter, showing that temperature alone is not the cause of failure. Along the south shore of the St. Lawrence, below the city of Quebec, where the temperature falls 30 degrees Fahr. below zero, good crops of the best varieties of European plums are regularly produced. The moisture of the air in this case appears favourable to the preservation of the flower buds, even though the temperature is low. There is a great difference, however, in the hardiness of the different varieties, and in time seedlings may be produced which will have flower buds capable of surviving the coldest temperatures which occur in cold districts in any winter. Sudden changes of temperature are hard on flower buds, but near large bodies of water the temperature does not change suddenly.

JAPANESE PLUMS.

Owing partly to their introduction being comparatively recent, partly to their vigour, productiveness and good shipping qualities, and partly to the way they have been boomed, the Japanese plums have been widely planted on this continent in recent years. Although introduced into America as recently as 1870, this class of plum is now almost as well known as the European. The origin of the Japanese plum is unknown, but it is thought to be a native of China. The Japanese were not very systematic in their nomenclature, and when the plums were introduced into America there was great confusion of names. They have, however, been fairly well worked out, and the best known and most profitable kinds can now be obtained true to name. Many seedlings have been grown in the United States and a large number of hybrids originated, some of which have great merit.

The fruit of most of the varieties is only medium in quality: a few, however, are good, and a still smaller number very good. The productiveness, firmness, appearance and good keeping qualities are what make these plums valuable. The majority of the Japanese plums are not as hardy in the flower bud as the European and some are much tenderer. They bloom very early, and on this account are more likely to be injured by spring frosts. The Burbank and Red June are, perhaps, the hardiest.

The Simon or Apricot plum *Prunus Simonii*, Carr., though not a Japanese plum has some of its characteristics and may be classed with the Japanese here. This

plum is thought to be a native of China and was introduced into America from France about twenty years ago. It has not been planted to any extent in Canada, nor is it widely grown in the United States. The tree is productive and the fruit is large and handsome, though inferior in quality. The fruit keeps and ships well. It does not appear to be any hardier than the Japanese plums. It has been grown with success in south-western Ontario, but is not a desirable plum to plant. It has been used as a parent in cross-breeding.

AMERICAN PLUMS.

These plums have a wide range on the American continent, being found wild from Mexico north to the province of Manitoba, and from the Atlantic to the Pacific oceans. They are represented over this great area by seven distinct species and six recognized groups or types. Of these, the cultivated varieties originating from the American wild plum *Prunus americana,* Marsh, and the Canadian plum, *P. nigra,* Ait,. include nearly all the American plums that are profitably grown in Canada. The more southern groups, of which a few varieties are partially successful, are: the Miner group, *Prunus hortulana mineri,* Bailey, which, is closely related to *Prunus americana,* but has some resemblance to the Wildgoose group; and the Wildgoose group, *Prunus hortulana,* Bailey. It is, however, only in the mildest parts of Canada that they are even fairly satisfactory. At Ottawa, the flower buds are injured and the crop light. The varieties of the Wayland and Chicasaw groups of plums,—two other important groups—are too tender for most districts in eastern Canada.

Americana Group.—This group has, up to the present time, furnished the best varieties of American plums. The range of *Prunus americana* as given by Hedrick in the 'Plums of New York' is as follows:—'The boundary line of its northern range passes through Central New York to Central Michigan, southern Wisconsin, Minnesota, and South Dakota, extending north westward to Manitoba and reaching its western limits in Utah. It occurs locally southward through Colorado to northern New Mexico. It is rare in Oklahoma and does not occur in Texas, but is represented in Missouri by a pubescent form. East of the Mississippi the typical species occurs in all of the States from Central New York southward to northern Florida.'

The tree is a spreading grower, sometimes reaching a height of twenty feet. On account of its spreading habit the trunk and large branches are often split or broken by winds when laden with fruit or by heavy snow storms in winter, and this is a serious drawback to some varieties especially. The varieties of this species bloom later than the Canada plum, *P. nigra,* and sometimes escapes frost from which the native species suffer, an example of which occurred in Ottawa in 1902 and 1913. The trees are very productive and the fruit is much improved in size by thinning. The fruit varies greatly in size and the colour ranges from yellow to red. The skin is generally tough, and often thick and astringent, but the flesh is moderately firm or firm, very juicy, sweet, and sometimes rich and high flavoured. The stone usually clings, but occasionally is almost or quite free. When growing wild, this tree is found thriving best in rich and rather moist soil, but under cultivation it succeeds very well even where the soil is comparatively poor and not very moist. It is only about sixty years since the Americana plums were thought worthy of cultivation, but during the past few years the cultivated and named varieties have increased so fast that there are now over two hundred of them. The size, appearance and quality are also very much improved. Indeed, the improvement is remarkable considering the short time in which it has been made, and we may hope for still greater improvement yet. The apparance of the plums is all that could be desired, and the best varieties are almost large enough,

but there is great room for improvement in the character of the skin and flavour of the fruit, although the latter is good. Earlier varieties are also wanted. The present fruiting season of the Americana plums at Ottawa is from the fourth week of August until about the last of September. Some varieties of this group are Bixby, Wolf, Hawkeye, Stoddard, Brackett and DeSoto.

Nigra Group.—From this group of plums, of which *Prunus nigra* is the species, will probably be originated the varieties which will be of greatest value in the northern parts of Ontario, and the coldest parts of the province of Quebec. This is the wild plum of Eastern Canada, having a range from the Maritime Provinces westward to Lake Huron. It is found in Michigan, in northern New York and in the New England States. It is also found in Newfoundland. Although in some places this species can scarcely be distinguished from *P. americana*, into which it seems to merge in some districts, in the colder parts of the provinces of Ontario and Quebec the tree is very distinct, and for this reason we prefer considering it a separate species although some good authorities make it merely a variety of *P. americana*. It is a more upright grower than *P. americana* and the wood is darker and tougher. The tree seldom breaks down like *P. americana*, which is a great advantage. It blooms earlier and has larger flowers than the Americana. The flowers also have a pinker tinge, especially when opening. The serrations of the leaves are rounded, not acute as with Americana and the leaves are broader than the latter. The fruit ripens early, and on this account is sometimes more profitable, as it can be marketed when there is little competition with other plums. Although the named varieties which are now upon the market are not as high in quality as the best of the Americana group, some of the wild seedlings are fully as good in quality, though not as large. The skin of the Canada plum is thinner than the other species and breaks up easier when cooked. The colour of the fruit varies almost as much as *P. americana*, but is more often entirely red with little or no bloom. The shape varies, but the fruit is more regularly oblong and oval than *P. americana* and is not flattened like that species. The Canada plums begin to ripen about August 1 at Ottawa, and the season extends to September. Very little has yet been done either in the United States or Canada to improve *P. nigra*, but as good results are as likely to be obtained as with *P. americana*. Some of the varieties of this group are Carstesen, Aitkin, Odegard, Cheney.

HYBRID PLUMS.

During the past ten years a number of hybrid plums have been placed upon the market. Most of the more prominent of these were originated by Luther Burbank, of California, who has devoted much time to this work. Few of his hybrids, however, which are now on the market have proved valuable in Canada. The parents of most of them are varieties which do not prove successful where the climate is severe. The warmer parts of Ontario, Nova Scotia and British Columbia, where the Japanese plums do well, are where they are most likely to succeed. Maynard is one of the most useful. The Omaha, a hybrid originated by Williams of Nebraska, is proving very valuable at Ottawa on account of its earliness. Hansen has originated some hybrid plums which are proving hardy in the colder districts.

There is a wide field for work in plum hybridization. If blood of the European and Japanese varieties can be introduced into the Americanas and Nigras and the hardiness of the latter maintained, plum culture in the north will receive a great impetus. It is not too much to hope that this will soon be accomplished, and, in the case of the Japanese and Americana, the Omaha is an example of a combination of these two.

PLUM CULTURE IN THE DIFFERENT PROVINCES OF CANADA.

A circular was sent out to leading fruit growers in the different provinces of Canada, in which certain questions were asked relating to plum culture in each province. From the replies, the following summaries have been made, which it is thought may prove useful.

Prince Edward Island.—The European plums succeed well in this province. The Japanese varieties are too tender, and natives are not desired. The quantity of plums grown on the Island is limited as the home market is not large. Plums have been shipped with good success to the mining towns in Cape Breton and Nova Scotia. Late spring frosts sometimes affect the crop. The trees, as a rule, bear heavily every other year, but are not long-lived. Black Knot is the most troublesome disease, and Shot-hole fungus also causes injury. Plum culture is considered profitable.

Nova Scotia.—The climate of the Annapolis and adjacent valleys and parts of the south coast is admirably suited for the culture of the European plum, and some of the Japanese varieties do well also. Large quantities of plums could be grown, but, owing to the small size of most of the towns, the market is limited at present. Cold, wet weather in spring, especially during blossoming time, and severe winters, affect the crop occasionally. Very early and very late varieties are profitable as they do not come so much into competition with Ontario fruit. Black Knot and Brown Rot are troublesome, but the latter is not so prevalent as in some other parts of Canada.

New Brunswick.—Except near the Lower St. John river and near the coast in Charlotte and some of the other counties, where a few of the hardier European plums do fairly well, the chief dependence must be in the Native and Americana varieties. Severe winters and late spring frosts are, occasionally, hard on the European plums. Black Knot is the most prevalent disease; and of insects, the Curculio. Local markets are good but they are mainly supplied with plums from other provinces.

Quebec.—With the exception of the south shore of the Lower St. Lawrence river where there is open water in winter as a result of which the European plums succeed admirably, it being possible to grow many more plums than is being done at present, the growing of plums is confined mainly to the Native and Americana varieties. Along the Ottawa Valley, in the vicinity of Montreal, and in the Eastern Townships, European plums give crops occasionally, but the winters are too severe to make them a commercial success except in the most protected places. In L'Islet and Kamouraska counties where most of the European and Domestica plums are grown, the growers are now canning their plums with good success. The season is very late, some varieties keeping into November. Good prices are obtained for native plums in local markets, but the larger cities and towns are supplied with European plums from western Ontario.

Black Knot is the commonest and most injurious disease. There is also some Brown Rot. Scab and Plum Pocket affect the native plums very badly and in some places they rarely mature because of these diseases, unless sprayed. Curculio is often injurious unless the trees are well sprayed.

Ontario.—The climate of a large part of western Ontario is suited to the culture of both European and Japanese plums and great quantities are grown in the Niagara district especially. Along Lake Huron further north, the European plums do well. Sometimes low temperatures in winter or spring frosts lessen the crop. In Eastern Ontario, only the hardiest European plums need be tried and it is only in an occasional year that there is a full crop of these, even in protected places, the

winters being too severe. The Native and Americana varieties do well in eastern and north central Ontario and early varieties bring good prices. In northern Ontario, the earliest native varieties should be tried.

In the plum districts, the Brown Rot is the most serious disease, but some varieties are not much affected. Curculio is controlled by spraying.

Where the Native plums are relied upon, the Scab and Plum Pocket make the crop very uncertain unless the trees are thoroughly sprayed. Taking one year with another, there is a fair profit in plums in Ontario.

Prairie Provinces.—In the Prairie Provinces the winters are too severe for any but the Nigra and Americana varieties, the Native varieties and the hybrids between the plum and the Sand Cherry. Early varieties are the most desirable as the later Americanas do not ripen. Spring frosts often prevent the setting of fruit of even the Native sorts. Good prices are given for Native plums when they can be obtained.

British Columbia.—Large quantities of plums can be grown in British Columbia, as the climate is admirably suited to their culture in many parts. The varieties that ship well are the most profitable. The Italian Prune (Fellenberg) is the variety most largely grown. The Japanese varieties succeed in the warmer parts. In the dry districts, there is little injury from disease, but on the lower mainland Brown Rot often causes great loss. Spring frosts sometimes lessen the crop. In the moist districts, moss on trees is sometimes troublesome unless the trees are well sprayed when dormant.

EXPERIMENTS WITH PLUMS AT THE CENTRAL EXPERIMENTAL FARM, OTTAWA.

Experiments with plums were begun at the Central Experimental Farm in 1888 and have been continued ever since. The testing of varieties to determine their hardiness, productiveness, and other qualities has been one of the most important experiments, and a large number of varieties have been tested. Experiments have also been carried on with various stocks, to learn which was the most satisfactory for the various classes of plums, and different methods of grafting have also been tried. The spraying of the trees with various mixtures and solutions to control fungous diseases and insect pests has also been an important part of the work. Careful records have been kept of the dates of blooming of the different varieties, and the information thus obtained is very useful, as it has been proven by Waugh and others that few varieties of American plums are self-fertile, and it is thus necessary to have, in most cases, some other kind blooming at the same time in order that fruit may set well. A table showing the blossoming period of the different varieties will be found in this bulletin. The yields from each individual plum tree are kept separate, and it is thus possible to tell whether one tree is bearing better than another. Much work has been done in testing and originating seedling plums, especially of the American varieties, and a few very promising sorts have been produced and introduced. More attention is now being paid to the Native species *Prunus nigra*. Some experimental work in cross-breeding has also been carried on.

The soil in the plum orchard is not as suitable as it might be, being a light, sandy loam but good plums are raised. The trees were originally 20 by 20 feet apart, but interplanting has been carried on and the trees are now 20 by 10 feet apart and some 20 by 15 feet. There are now 323 trees in the orchard. In addition there is a large number of seedlings planted 10 by 10 feet apart.

Following are the number of varieties of each group or class in the orchard and nursery:—

Group or Class.	Number of Varieties.
European	24
Americana	65
Nigra	8
Miner	2
Wayland-like	1
Hybrid	19
Total varieties	119

SEEDLING VARIETIES.

While there are many fine named varieties of plums which succeed in the more favourable parts of the provinces of the Dominion, there is always the possibility of getting something better. In the colder parts of the provinces where few of the better plums succeed, there is a fine opportunity for developing hardier and better kinds. One of the easiest and best methods of obtaining new varieties is by growing seedlings from the stones of the best plums which have ripened in the district where new kinds are desired, and if no plums have yet been grown these stones should be procured from the nearest place where they can be obtained. The European plums have been improved for so many centuries that it will be difficult to obtain a seedling plum of this class which will be better in quality than the best now in cultivation, but the prospects for obtaining trees with hardier fruit buds are very bright. The native and Americana plums have been, relatively speaking, little improved as yet, and there is a wide field for development here. Stones should be saved from the largest plums from the most productive tree of the variety of which seedlings are desired. These stones should, when possible, be planted immediately after the fruit is ripe, as if the stones become dry they will not germinate as well, and sometimes will not grow at all. If they are planted at the time the fruit is ripe it is not necessary to remove the pulp. If the stones cannot be conveniently planted at this time they should not be allowed to become dry. They may be kept over winter in boxes mixed with sand, which should be moist but not wet. A layer of sand about one inch in thickness is put in the bottom of the box and is merely covered with a layer of stones, the latter are then lightly covered with sand and another layer of stones on top, and so on until the box is filled. This is called stratification. The box should be buried outside where there is good drainage and no danger from small animals, or kept in a cellar. If the stones freeze when they are thus moist in sand they will crack and seedlings grow quicker in the spring, but there is a danger of their drying out when exposed to the frost unless the box is buried. Stones spread outside in the autumn in a well drained place and lightly covered with soil will often come through the winter in fine condition.

The stones should be planted not more than one inch deep (often they are planted too deep) in good loamy soil, in rows three feet apart and dropped from one to two inches apart in the rows. These usually germinate in the spring, but if the stones have become dry before planting few, if any, will germinate the first year but the next year, if they have not been too dry before planting they will germinate well, if not disturbed. The soil should be kept thoroughly cultivated during the summer to induce a thrifty growth. The next spring or the one following, the young trees should be planted out about ten feet apart and left to fruit, which they will do in from three to six years. Scions may then be taken from the promising varieties and grafted. Stones planted from the best of these will be likely to produce something still better. As many of the seedling plums, especially of the Americana and native varieties are as good as their parents, the ground on which they are growing is not lost as the fruit can be sold to advantage.

European plum top-grafted on Nigra plum three feet from ground.

CROSS-BREEDING.

New varieties of plums may be obtained by cross-breeding, and by this method one is even more likely to obtain the kind of plum desired, but the time for this work is so limited, being only a few days when the flowers are opening, that only specialists can very well undertake it. The method of crossing is explained in Bulletin No. 37 on Apple Culture.

PROPAGATION.

The plum is propagated principally by budding and grafting, although a few varieties will strike more or less readily from cuttings, and some kinds when on their own roots are increased from suckers.

STOCKS.

While it has not yet been clearly proven that the stock on which a scion is grafted will materially change the flavour or season of the fruit, it does affect the vigour and fruitfulness of the tree in a greater or less degree. If a scion is grafted on a dwarf stock the tree will be dwarfed and will come into bearing sooner than if grafted on a thrifty stock, as anything which checks the growth of the tree promotes early fruitfulness. It is possible, however, especially in top grafting, to have such a slow growing stock that the graft outgrows it too much and the tree becomes top heavy and if it does not die owing to a poor circulation of sap, the graft is liable to be broken off by wind. The tree in the accompanying cut (a European plum top-grafted on *Prunus nigra*) was killed because there was not a free circulation of sap. The stock also, if it is tender, may be winter killed, and a tree which may be perfectly hardy above ground is ruined by being grafted on such a stock. Nurserymen find that the scion influences the root system of the stock, but it is not so clear that the scion or graft makes the scion any hardier.

If a tree is planted deep enough, roots may be thrown from the scion and the tree will eventually be on its own roots, but this should not be depended on as a rule, and

a stock should be used that will be hardy, give a good union, and make a thrifty tree.

The two main stocks used in grafting and budding the plum are the Myrobolan and Marianna.

Myrobolan.—This is a European plum, *Prunus cerasifera,* and is imported principally from France. It unites readily with the scion and throws few suckers, which makes it a very desirable stock, where the winters are not very severe. It is used very generally in America, but more in the north than in the south where the Marianna is chiefly used. The Myrobolan plum is not a satisfactory stock for the colder parts of Ontario and Quebec, as it is liable to winter kill.

Marianna.—The Marianna plum is used largely in the southern States as stock, where it propagates freely from cuttings. It is thought to be a hybrid between the Myrobolan and the Chickasaw plums. This, also, is not a desirable stock for the colder parts of Ontario and Quebec.

Peach.—The peach unites readily with the plum and is used very largely in the United States as a stock for it. It can be grown cheaply, and strong young stocks are readily obtained for grafting and budding. It has, however, the disadvantage of not being hardy enough in many parts of Canada.

St. Julien.—The St. Julien is a European stock that is used to a limited extent in America for propagating the European plums, but the Myrobolan and Marianna stocks can be obtained so cheaply that it is not used much now. The St. Julien is, however, the safest stock for European plums in the north.

Americana and Native.—Americana and Native plum seedlings furnish the best stocks for the colder parts of Canada. The young trees make strong growth and are very suitable as stocks for grafting and budding. This stock is not usually satisfactory when the European plums are top grafted on it, as the top outgrows the stock and either breaks off from being top heavy or dies from lack of nourishment, as the native varieties, especially, grow much more slowly. No bad results, however, have followed from root grafting the European plums on American stock, and good thrifty trees have been obtained.

Sand Cherry (*Prunus pumila*).—The Americana plums have been successfully root grafted on the Sand Cherry at the Experimental Farm, and trees which had been grafted nineteen years were still in good condition with a perfect union and bearing well when they had to be removed. The trees are considerably dwarfed by this stock. The Sand Cherry may prove very useful where close planting is adopted, as many more trees could be planted on an acre when dwarfed by this stock. Trees grafted on this stock, however, are not as firm in the ground as we should like, and strong winds have a tendency to loosen them.

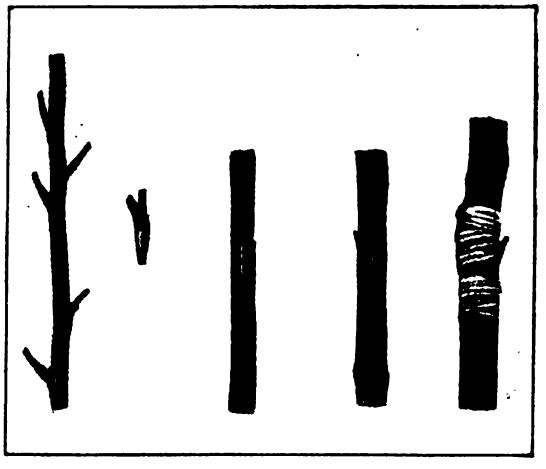
BUDDING.

The favourite method of propagating plums is by Shield budding, and the best season for doing the work is in late summer, some time during August being the best time in Ontario and Quebec. At Ottawa the trees have been found in good condition during the second week of August. In some parts of Canada the time will be earlier and in other parts later. Young stocks one or two years old are the most satisfactory.

Budding is best performed when there is still sufficient sap beneath the bark to permit of the latter being easily raised with a knife. On the other hand, if the work is done when the tree is still growing vigorously the bud is liable to be 'drowned out,' or, in other words, forced out by reason of too much sap and growth of the stock.

The stock which is to receive the bud should be at least three-eighths of an inch in diameter near the ground. The lower leaves are rubbed off to a height of five or six inches to enable the budder to work more freely. A perpendicular cut is now made in the stock as near the ground as possible from an inch to an inch and a half long and preferably on the north side of the tree, as the bud will not be so readily dried out by the sun on that side. The cut should only extend through the bark. Another cut should now be made across the top of the perpendicular one. The two cuts when made will appear thus: T

The buds are cut from well developed and ripened shoots of the current season's growth of the variety it is desired to propagate. Before the buds are removed the leaves should be cut off the shoots; a piece of the petiole or leaf stem is left, however, by which the bud may be handled after it has been removed. A very sharp, thin-bladed knife is necessary in removing the bud. Knives are specially made for this purpose. The bud is cut off the shoot downwards or upwards, whichever is more convenient, the general practice, however, is to cut upwards. The length of the piece removed with the bud should be about one inch long, and the cut surface smooth. It should be quite thin, as but little of the wood is taken with the bud. The buds or twigs should be kept where they will not dry out while the work of budding is going on. The bud is inserted under the bark by raising the latter with the blade of the knife or the part of the budding knife made for that purpose. The bud is then pushed down and under the bark with the fingers, and finally the piece of leaf stock which was left when it was removed from the twig is pressed with the blade of the knife to bring the bud into the proper position. The bark on each side of the bud, which should now be under the bark of the stock, will hold it in position. In order to bring the bud and stock into close contact and prevent the former from drying up before the union takes place, they should be tied tightly together with raffia or some soft string, taking care not to cover the bud with it. The bud should unite with the stock in two or three weeks, and after that time the string should be cut, as otherwise the bud may be injured. If the proper season has been chosen for the work the bud should remain dormant until the spring. If it starts in the autumn it may be killed during the winter. In the following spring the stock should be cut off just above the bud which will cause all the strength of the stock to be directed into the bud and produce rapid growth, three to five feet not being an exceptional growth for the first season.



Sample of Shield budding.

Budding is now a very popular method of propagating plums. The first season's growth is greater than from root-grafted trees and there is a larger proportion of straight trunked trees by this method. If it is desired also to prevent trees from growing on their own roots, budding is preferable, as trees propagated in this way may be planted so that the stock is just at the surface of the soil and all roots are thrown from it. We have not found root-grafting as successful with plums as with apples and budding is recommended.

Buds may also be inserted in the branches of trees with good results. When the buds have united and grown the top may be shaped up as if top grafted, but this is seldom done with plums.

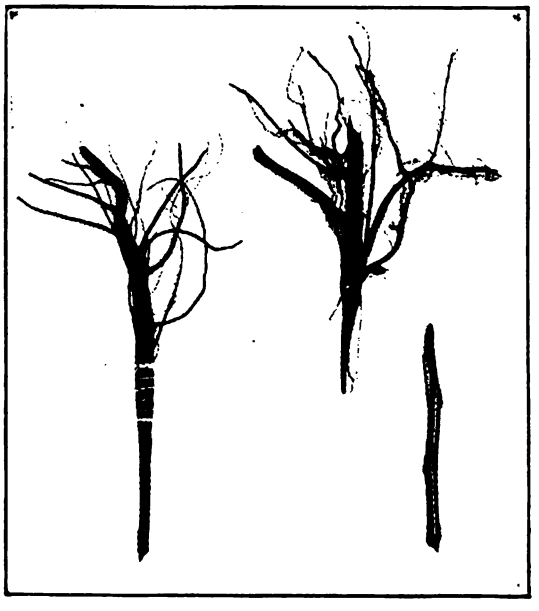
GRAFTING.

Scions.—As much of the success in grafting depends on the condition and quality of the scions, too much stress cannot be laid on the importance of having them of the best quality and in the best condition at the time of grafting.

Scions may be cut any time after the wood is well ripened in the autumn and before the buds begin to swell in the spring. The best time, however, is in the autumn, as they may then be kept in the condition desired. If they are cut in cold weather, in winter, there is less sap in the scions at that time and thus the chance of their drying up is greater than if they were cut in the autumn. One cannot tell very well, either, in winter whether the young wood has been injured or not. Scions should be cut from healthy, bearing trees. The wood of old trees is liable to be diseased, and if diseased wood is used it is likely to produce a diseased tree when grafted. Scions should also be cut from the most productive trees. Occasionally, one or more trees of a variety will produce more and heavier crops than the others. If scions are taken from these trees, there may be a larger proportion of the grafted trees produce crops like the trees from which the scions were taken than they otherwise would, though this is not yet conclusively proven. The scions should be cut from the wood of the current season's growth, as older wood is not satisfactory. The buds should be well developed and the wood thoroughly ripened. It is not wise to use the water sprouts or young shoots which spring from the main branches or trunk for this purpose. They may not be thoroughly ripened, and it is also possible that sprouting propensities may be thus more developed in the grafted trees. The entire season's growth may be cut off and packed away until required for grafting, when it should be cut into pieces from four to six inches in length having three well developed buds.

Scions may be kept in good condition in moss, saw-dust, sand, or forest leaves. The last named are found very satisfactory at Ottawa. These materials should be slightly moist, but not wet; the object being to keep the scions fresh and plump without their being any danger of their rotting. They should be kept in a cool cellar which is not too dry, and should remain dormant until ready for use.

Root Grafting.—Plums are propagated successfully by root grafting, although budding is more general and gives, as a rule, much better results. Strong one year old or two year old stocks are heeled in during the autumn in a cool cellar in moist sand. Grafting may be done any time during the winter, but it is usually not stated until January or February. Whip or tongue grafting is the method usually employed. As only the root is required, the trunk and branches are cut off and thrown away. As there is



Example of Root Grafting.

Cottrell Plum in Bloom. – Typical Tree of *Prunus americana.*

but little advantage in using the whole root, it may be divided into several pieces much depending on its size. Each piece should be at least four inches long. A smooth, sloping cut upwards, about two inches long, is made across the main part of the root most suitable to receive the scion. The scion is prepared by cutting off a piece of the wood procured for this purpose in the autumn from four to six inches long and with about three well developed buds on it; a smooth, sloping cut downwards and across it is now made of about the same length as that already made on the stock. Clefts are now made in the sloping surface of both scion and stock, in the former, upwards; and in the latter downwards. They are then joined together by forcing the tongue of the scion into the cleft of the stock. The inner bark, or cambium, of both scion and stock, should be in contact with one another on at least one side of the graft, as it is at this point of contact where the union begins to take place. In order to ensure a speedy and successful union, waxed cotton thread is wound tightly around to hold the parts together. Amateurs are also advised to rub grafting wax all over where the two parts are joined, as with this treatment, success is likely to be more certain.

The operation having been completed, the grafts are packed away in moss or sawdust until spring. They are then planted out in nursery rows about three feet apart and one foot apart in the rows, the point of union being about three inches below the surface of the soil. The ground should then be kept thoroughly cultivated throughout the season.

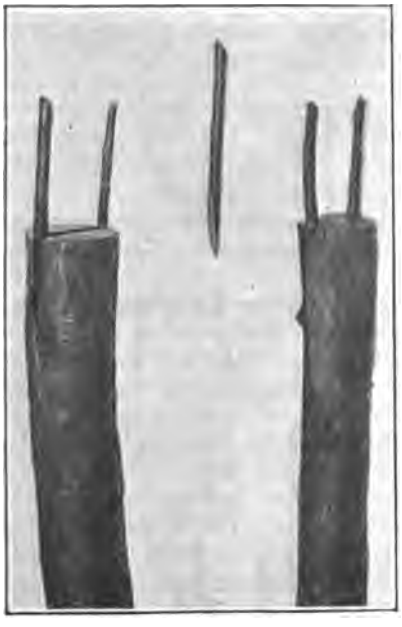
Crown Grafting.—Crown grafting is usually done on young stocks in the nursery row in the spring. The trees are cut off at or just beneath the surface of the soil at the crown or collar. A sloping cleft is then made in the side of the crown and a scion, cut wedge-shape at the lower end, is inserted in the cleft. The same precautions should be observed as in root grafting, of having the inner bark of both stock and scion touching on at least one side. The grafted part should then be well covered with grafting wax, in order to exclude the air. The trees usually make a strong growth when grafted in this way, but as the work has to be done in April before growth begins it is often inconvenient to do it at that busy season of the year.

Top Grafting.—Plum trees are not top grafted as frequently as apple trees, but they can be very successfully grafted in this way. When there are trees which produce poor or unprofitable fruit they may be made to bear good fruit by top grafting other varieties upon them. An unsymmetrical top may also be improved by top grafting. European or Japanese varieties should not be top grafted on Americana or Nigra stock. In our experience at the Central Experimental Farm it has been found that although a good union is made, the European will outgrow the Americana so much that the top will die a few years after grafting, the trunk of the stock expanding too slowly. In top grafting plums it is best to have both stock and scion as nearly related botanically as possible. Top grafting is done in the spring before growth begins, and early grafting is more important with the plum than the apple. As the shock to a large tree would be very great if all the branches, on which leaves develop, were cut off the first season, about three years should be devoted to changing the top of the tree. Cleft grafting is the method usually adopted in top working plum trees, it being simple and satisfactory.

The branches to be grafted should not exceed one inch and a half or two inches in diameter. If they are larger, it is so long before the stub heals over, that disease may set in. It is possible, however, to graft larger branches by putting in more scions. The top grafting of a large tree should be done with a view to having the new top as symmetrical as possible, and great care should be taken in selecting the branches to be grafted upon. After the branch is sawn off it is cleft by means of a mallet and strong knife to the depth of an inch and a half to two inches. It is held open to receive the scion by driving a wedge in it. Scions for use in top grafting

are cut from dormant wood which has been kept in good condition in the manner already described. They should have about three strong buds, and be cut wedge shape at the base, one side, however, being a little thicker than the other. Two scions are now inserted in the cleft of the stub, with the wide side of the wedge on the outside, and thrust down until the lowest bud is almost on a line with the edge of the stub. The inner bark of both scion and stub should meet at some point, so that the union will take place readily, and this is more easily effected if the scion is given a slightly outward slope when inserted. When the wedge has been withdrawn from the cleft the advantage of having the wedge-shaped end of the scion thicker on one side will be apparent, as it will be held much more tightly than if both sides were the same. If the scion is not a tight fit all along, there is something wrong in the way it has been cut or the stub has been cleft. The cut parts should now be covered with grafting wax to exclude the air and hold the scion in place. Cotton is also sometimes wrapped around the wax in order to more effectively hold the scion in place. If both of the scions grafted on a stub should grow, the weaker one should be removed after the other is well united and the surface of the stub at least partially healed over.

It is often desirable to top graft young trees, and this may be done very readily. The main branches are cut back to within a short distance of the trunk, and the scions grafted on, either by cleft or whip grafting. The closer the grafted part is to the trunk, the better, as the tree will be stronger than if the union occurred further out on the limb, since the growth of graft and scion may not be equal. It is possible to cut off the whole top of the tree and graft successfully on the main trunk, when the tree is young, but unless one is sure that the union will be perfect and the top not outgrow the stock, it is better not to run the risk of losing the tree. Furthermore, if the whole top is cut off there will be such a growth the first season that the scions are liable to get broken off. In top grafting a young tree that has been planted from three to five years, it is better to take two seasons to do the work, as the results will be, as a rule, more satisfactory.



It is necessary to examine the grafted trees during the summer and remove any young shoots from the stocks which are interfering with the scions. It is not wise, however, especially when the tree has been cut back severely for grafting, to remove all the shoots until the grafts have grown considerably and furnish a good leaf surface.

MATERIALS NEEDED IN GRAFTING AND BUDDING.

While grafting implements and appliances are numerous, the work can be done with a few, and as it is not often convenient for the farmer or fruit grower to get a large outfit, only the really necessary things are mentioned. These are:—A sharp, fine-toothed hand saw, to be used for sawing off large limbs, or for making the stubs on trees to be top-grafted where the limbs are too large to be cut with the pruning knife.

A strong pruning knife for cutting the smaller limbs; for smoothing the wounds made by the saw or pruning shears; for trimming off torn edges of branches, and for pruning roots of young trees when planting.

A budding knife, with a thin steel blade, for removing buds, having an ivory handle which is made thin at the end and is used for raising the bark.

A grafting knife, which is used in top-grafting trees. Home-made grafting knives can be easily made. A strong, sharp blade is the chief requisite.

Pruning shears, which are intermediate in their uses between the saw and the pruning knife. They are used for cutting off branches which are too large for the latter and too small to need the saw; for rough pruning and for cutting scions.

A wedge and mallet are also necessary in top-grafting large trees.

Raffia, which is one of the best tying materials. It is very strong and very pliable, and is particularly useful for bandaging when budding.

Cotton yarn, which is used for tying root grafts, and is one of the most satisfactory materials for the purpose. The size known as No. 18 knitting cotton is the best. It is bought in balls, which should be soaked for a few minutes in melted grafting wax before using. The yarn may also be drawn through melted wax, which ensures its all being thoroughly soaked, and is, perhaps, on this account preferable to soaking the ball.

GRAFTING WAX.

There are many kinds of grafting wax recommended, but it is unnecessary to enumerate them all. One of the cheapest and best is made as follows:—

Formula I.—Resin, 4 lbs.; beeswax, 2 lbs.; tallow, 1 lb. Melt together and pour into a pail of cold water. Then grease the hands and pull the wax until it is nearly white. A good wax for either indoor or outdoor use. This should be heated before using if too hard.

Formula II.—Resin, 2½ lbs.; beeswax, ½ lb.; boiled paint oil, 10 ounces. Make up as in Formula I. This wax is more suitable for outside in cool weather than Formula I, as it remains more pliable.

The principal value of grafting wax is to exclude air from the wound, and thus prevent the wood from drying before a union takes place. A good grafting wax should not crack when on the tree, else the air will reach the wound and the wax prove of little value. Many materials may be used instead of grafting wax for this purpose, one of the simplest being a mixture of clay and cow dung, but grafting wax is much to be preferred. Strips of cotton are often used, especially in top-grafting and crown-grafting, for wrapping around the wound after the wax has been applied for the purpose of helping to exclude the air, and also to assist in holding the scion in position until the union takes place. This cotton is unnecessary if good grafting wax is used; but if a very valuable variety is grafted it is safer to use the cotton, as when the growth of the scion is rapid there is a chance of its getting broken off during the first season before it is thoroughly united with the stock. Large wounds on trees should be covered with some material that will protect the cut surface from the weather, prevent disease from setting in, and which will not peel off easily. A good dressing of white lead paint is probably the best material to use for this purpose. Grafting wax may be used on smaller branches.

THE NURSERY.

Although, as a rule, it will be the most convenient plan to buy trees from the professional nurserymen, yet he who propagates plum trees by root grafting, crown grafting, or budding, for his own use, should have a nursery in which to grow them until they are ready for the orchard. A good sandy loam soil, which does not bake

and is well drained, is best suited for this purpose, and will grow the strong, healthy trees which are desired. The ground should be thoroughly prepared and the young trees planted about 12 inches apart, in rows about 3 feet apart. Cultivation should be thorough up to about the middle of July, when it should cease, as in colder climates, especially, it is very desirable that the wood ripen well, and late cultivation would encourage late growth. It will be necessary the first year the grafted or budded trees are growing in the nursery to go over them carefully and cut out any shoots which may be coming from the stocks, and also to reduce the graft to one stem should more develop. If any side branches grow, however, they should be left intact. In small nurseries it is sometimes advisable to tie the young trees to stakes the first season. This will make them straighter and will help to keep them from being broken. These trees may be planted in the orchard the following spring if one-year old trees are to be used. By the end of the second year or the beginning of the third, after the branches have been pruned to the proper height and the tops shaped, the trees will be in the best condition for planting in the orchard.

THE ORCHARD.

Soil and exposure.—Plums will succeed well on a great many kinds of soils, but some appear to succeed better on certain soil than others, the best soil depending somewhat on the climate in which the plums are grown. In those sections of Ontario where the European plums succeed best, well drained clay loam has given the most satisfactory results. Along the south shore of the St. Lawrence, below the city of Quebec, where the European plums succeed well, these plums do better on sandy loam soils. The Japanese plums on the whole give better results on warm loamy soils than on clay loam. The Americanas and Nigra plums succeed best on clay loam soil, but also do well on sandy loam. All soils should be well drained or success need not be expected. The more severe the climate in which the plums are grown the warmer the soil should be.

If there is danger from spring frosts a northern or north-eastern exposure would be likely to give best results, as the flower buds would not develop as soon as on a southerly exposure. The flower buds of the European and Japanese plums suffer badly in the north, and there is no doubt that a northerly exposure would be best for these plums.

Preparation of the land.—It very often happens that the farmer or fruit grower suddenly decides to plant an orchard. No previous thought had been given to the matter, or if there had, nothing was done to get the land into better condition for the young trees set out to take their chances. No after cultivation will fully make up for neglect of the thorough preparation of the land. Trees should begin to grow thriftily from the time they are planted if they are to obtain a good size before they begin to bear heavily, and if the land is not thoroughly prepared and in good condition when they are planted, growth is likely to be slow. It is much better, if one has no land in good condition, to delay planting a year, and give the soil the necessary attention. The time will not be lost, as the trees will do much better. Land which has been well manured for root crops, ploughed in the autumn, and again ploughed in the spring and thoroughly levelled and pulverized with the harrow should be in good condition for planting the trees. If the subsoil is near the surface the subsoil plough should be used after the ordinary one, loosening the soil from four to six inches deeper than the former.

Sod land ploughed in the autumn, top dressed in the spring with a good coating of barn-yard manure and then ploughed again and thoroughly pulverized with the harrow, should also bring the soil in good condition. A green crop, such as clover

Plum Orchard on Niagara Peninsula.

ploughed under in the spring and the land thoroughly harrowed, would also be a very good method.

Laying Out of the Orchard.—Plum trees require thorough spraying, and this should be taken into consideration when planting, so that the trees will not be set too close. Trees should also have abundance of sunlight to thrive best and produce fruit of good colour, and they cannot obtain this if they are too crowded. There are several good methods which may be adopted in laying out the orchard.

If the trees are planted the same distance apart each way with a view to leaving them all as permanent trees, they should be planted from 15 to 20 feet apart, depending on the varieties chosen. If, however, the branching and upright growing varieties were mixed as might be necessary for good pollination, 18 feet apart would be a very satisfactory distance to plant.

Another good method is to plant the trees a greater distance apart one way than the other. This is a satisfactory system when properly carried out. By this plan trees may be planted successfully 10 feet apart in the rows with the rows 15 feet apart, the latter distance leaving ample room for spraying. When the trees become crowded, every other one may be taken out, thus leaving the permanent trees 20 by 15 feet apart.

A third method is to plant the trees in an apple orchard with the object of getting some profit from the land before the apple trees come into full bearing.

If the permanent apple trees were 35 by 35 feet apart, a row of plum trees 17½ feet apart in the row could be planted between the rows of apple trees. Plum trees could also be planted between the apple trees in the rows. This would leave the plum and the apple trees 17½ feet apart. Planted in this way, large crops of plums can be produced before it is necessary to cut the trees out. As plum trees require weaker spraying mixtures than apples, planting plums among apples is not recommended.

Windbreaks.—If the orchard is not naturally protected from the wind by trees or by rising ground, a windbreak may be planted with good effect along the north and west sides, or any other side from which the greatest injury comes, the object being not to stop the wind altogether, but simply to check its velocity, as if a windbreak is high and very dense it stops the circulation of air in the orchard to a large extent, and this gives very favourable conditions for the spread of both insect pests and fungous diseases. On the other hand, a proper windbreak lessens the force of the wind and thus protects the trees, which will grow straighter and shapelier; it will also very materially lessen the amount of windfalls, and it will permit of growing varieties which will not succeed under ordinary exposure. Wind is one of the most important factors in drying out the land and causing drought. If its force is checked by a windbreak the evaporation of moisture from the soil will not be so great.

One of the best trees to plant for a windbreak is the Norway spruce (*Picea excelsa*). It is a rapid growing evergreen and is hardy almost everywhere where plums can be grown successfully. A single row of these trees planted from 8 to 10 feet apart is quite sufficient. They should grow, if properly cared for, at the rate of from 2 to 3 feet a year until they reach a height of 50 to 60 feet. In very exposed places it may be desirable to plant two rows of trees, the trees forming the second row being planted between and 8 or 10 feet behind the trees in the first row. The first row may be composed of arbor-vitæ, which are rather slow growing, and the row behind made of Norway spruce, if desirable. White pine and European larch are rapid growing trees which may be used for this purpose. Scotch pine is inclined to be irregular in growth, and is, on this account, sometimes not satisfactory. If the trees already mentioned cannot be obtained there are other native trees which will give good satisfaction. The windbreak should not be planted nearer than 40

feet from the first row of fruit trees. The trees in the windbreak may be thinned out somewhat later on if desirable.

Kind of Trees to Plant.—Plum trees one or two years of age will give the best satisfaction. If the planter does all the cultivation himself, small trees will be more satisfactory, as they start more readily than larger ones, but if hired help is employed, a good sized tree is important, as small sized trees are liable to be tramped down or otherwise injured. The paragraph on stocks should be read carefully, as the stock of the plum plays an important part in the growth of the tree.

Planting.—The spring is the best time to plant plum trees, and the earlier it is done the better, providing the soil is dry enough to work without puddling. Plum trees suffer more from late planting than apple trees. The trees may be planted with success in the autumn if the work is done early, as they will throw out roots before winter, but if planted late they are very likely to be killed by drying out. As it is of the greatest importance to get the trees planted early in the spring, and as when ordered from nurserymen in the spring it is difficult to get them as early as required, a good plan is to order them to be delivered in autumn and when received heel them in well drained soil until spring. After the trees are taken out of the soil great care should be taken to prevent the roots from becoming dry before planting, as if they do the tree is almost sure to die. Dipping the roots in a thin mixture of clay loam and water will protect them somewhat, but wet burlap, old bags, or wet straw should also be used. Before exposing the roots of the trees, however, the holes should be made. Many planters seem to have the idea that if they dig a hole barely large enough for the roots to be crowded into they will have good results. Sometimes they do; much oftener they do not. If the whole field has been subsoiled and is in a thorough state of tillage it would not matter so much, as the soil all over would be in the same state of friability, but this is very rarely the case. So that, as a rule, it is necessary to make the hole somewhat larger than will accommodate the roots, spread out to their full extent. It should be made about 18 inches deep, after which the subsoil should be loosened a few inches more, but not removed. In digging the hole, the surface soil should be kept separate from the subsoil or that of poorer quality. Sufficient surface soil should now be thrown back in the hole to make the tree, when planted, about an inch deeper in the ground than it was before. If a tree is not planted deep enough, the roots may become exposed and the tree die. On the other hand, it should not be planted too deep. Before it is planted permanently in the hole, the soil which has been thrown in should be raised and rounded off in the centre. If this is done, the roots of the tree can be spread out much more readily and placed more in their natural position. Roots of plum trees have not many fibres, and it is necessary to spread what are left on the tree, carefully, in order to get the best results. Broken or bruised roots should be cut off before planting the tree.

The tree being now placed upright in the hole and the roots carefully spread out, the surface soil is gently thrown in and worked in among them, by the hand, if necessary. It is very important to have the soil come in close contact with the root fibres, in order that the best conditions may be afforded the tree to begin growth promptly. When the roots are well covered, more good soil should be thrown in, and when the hole is about half full it should be well tramped with the feet, after which the hole should be filled level with the surface of the soil, tramping being done while it is being filled. The surface of the soil should be left loose, as this will help to prevent evaporation of moisture from the soil which has been thrown in. It is not necessary to water any tree if planting is done at the proper season and the soil fairly moist and well compacted about the roots.

If one year old trees are used all side branches should be removed and the trunk pruned back to a height of two or three feet above the ground, leaving the tree a

mere whip. The branches of two year old trees should be pruned back so as to leave only about four buds on each, but from four to six branches are all that are necessary to make a good and symmetrical top, and others should be cut back to the trunk. The Stringfellow method of planting, which consists in cutting back the roots to a stub and the top to about eighteen inches from the ground and planting in a small hole, should be practised with caution in Canada, and is not recommended.

If the orchard is in an exposed position and the trees large and with high trunks, it will pay to tie stakes to them to keep them from getting loose.

In districts where drought is liable to occur, or even in places where the soil is likely to become rather dry, and thorough cultivation cannot be frequently given, it will be wise to mulch the newly planted trees to a depth of from 4 to 6 inches with manure, straw, sawdust, or anything of that nature which will not become a compact mass. If this is placed about the base of the tree and left during the summer it will keep the surface soil loose and prevent evaporation of moisture, and the growth of the trees will be much more rapid. A good mulch may be the means of preventing a tree from dying if the season is very unfavourable or the tree in poor condition. If the mulch is loose when winter sets in there may be danger from mice, and this should be guarded against.

VARIETIES.

Although a large number of varieties of plums is now offered for sale by nurserymen, the number which can be recommended and suggested as worthy of trial is comparatively limited. Few additions have been made of late years to the list of best European plums, the greatest number of new named varieties having come either from the Japanese and Japanese hybrids or the Americana plums. Much improvement has been made in the Americana and other North American plums, and a great many named varieties have been introduced, no less than 165, exclusive of hybrids, having been tested at the Central Experimental Farm. The total number of named varieties of plums tested is 314.

The plum season extends over a period of about three months, beginning about the 1st of August, and ending late in October or early in November, although along the River St. Lawrence below the city of Quebec some European varieties will keep until December.

By a judicious selection, varieties may be planted which will give an unbroken succession of ripe fruit during this period. The market to which the plums are to be sent should also be carefully considered, as if they are to be sent long distances the firmer varieties will be the most satisfactory.

Although the varieties recommended are likely to be the most suitable, the intending planter should learn what varieties are proving the most profitable in his vicinity. This is important, as the districts are large and conditions will vary somewhat from one end of a district to the other. The lines dividing the districts are not arbitrary. It is not possible to make an exact dividing line on one side of which a variety will do well and on the other side of which it will prove a failure. The boundary lines are suggestive only. It is often the case that there will be especially unfavourable locations for orchards in a milder district in which it would be safer to plant the varieties recommended for a colder one. The planter should use his judgment in the matter.

The varieties recommended in the following list are arranged, as far as possible, in order of ripening, beginning with the earliest. It was only through the kindness of a large number of Canadian fruit growers that it has been possible to prepare a list of the best varieties for the different districts. These men have given the results of their experience most willingly, and I take this opportunity of again thanking them publicly for their assistance.

PRINCE EDWARD ISLAND.

Commercial.—Arctic, Bradshaw, Lombard, Field, Quackenboss or Glass, Yellow Egg, Grand Duke, Monarch, Shropshire Damson.

Additional Varieties Suggested for Home Use.—Washington, Imperial Gage, Victoria and Reine Claude.

Japanese plums are not reliable.

NOVA SCOTIA.

Counties of Cumberland, Colchester, Pictou, Antigonish, Inverness, Victoria, Cape Breton, Richmond, Guysborough, Halifax:—

Commercial and Domestic.—Arctic, Bradshaw, Imperial Gage, Gueii, Shipper's Pride, Yellow Egg, Quackenboss or Glass, Shropshire Damson.

Burbank plums succeed in the protected and most favoured localities.

Counties of Hants, Kings, Annapolis, Digby, Yarmouth, Shelbourne, Queens, Lunenburg:—

Commercial.—Bradshaw, Diamond, Yellow Egg, Archduke, Grand Duke, Monarch, Golden Drop (Coes), Shropshire Damson.

Additional Varieties Suggested for Home Use.—Bradshaw, Washington, Imperial Gage, Reine Claude.

Some of the most desirable Japanese and hybrid plums are Red June, Abundance, Burbank, Shiro, and Apple, but these are not so reliable as the European plum.

NEW BRUNSWICK.

Lower St. John Valley, Charlotte, and Albert Counties near the coast:—

Commercial and Domestic.—Arctic, Lombard, Green Gage, Yellow Egg, Quackenboss, Glass, Mount Royal, Raynes.

Remainder of New Brunswick:—

Americana and Nigra.—Aitkin, Bixby, Mankato, Omaha, Cheney, Wolf, Schley, Brackett, Hawkeye, Stoddard.

ONTARIO.

Counties of Essex, Kent, Bothwell, Elgin, Norfolk, Haldimand, Welland and Lincoln, and the southern part of the counties of Lambton, Middlesex, Oxford and Wentworth.

Varieties Recommended for Market:—

European.—Bradshaw, Imperial Gage, Shipper's Pride, Lombard, Yellow Egg, Reine Claude (Bavay), Golden Drop (Coes), Italian Prune, Grand Duke, Shropshire Damson, Monarch.

Japanese.—Red June, Abundance, Burbank, Chabot.

Additional Varieties Suggested:—Shiro (Hybrid.)

European Varieties Recommended for Home Use.—Washington, Burbank, Bradshaw, Imperial Gage, Reine Claude (Bavay), Italian Prune.

Counties of Wellington, Dufferin, Waterloo, Halton, Peel and Brant and the eastern part of Oxford, the northern part of Wentworth, the western part of York and the southern part of Simcoe.

Varieties Recommended for Market:—

European.—Bradshaw, Gueii, Imperial Gage, Shipper's Pride, Lombard, Pond, Yellow Egg, Glass, Reine Claude (Bavay).

Additional Varieties.—Mount Royal, Raynes.

Varieties Recommended for Home Use.—Washington, Burbank, Bradshaw, Imperial Gage, Lombard, Reine Claude (Bavay).

The northern part of Lambton, Middlesex and Oxford; the counties of Perth, Huron, Bruce and Grey and the county of Simcoe, with the exception of the extreme southern portion.

Varieties Recommended for Market:—

European.—Bradshaw, Purple Egg, Imperial Gage, Lombard, Quackenboss or Glass, Yellow Egg, Reine Claude (Bavay), Monarch, Grand Duke.

Japanese.—Burbank.

Varieties Recommended for Home Use:—

Washington, Burbank, Bradshaw, Imperial Gage, McLaughlin, Monarch, Reine Claude (Bavay).

The county of York, with the exception of the extreme western portion, and the counties of Ontario, Durham, Northumberland, Prince Edward, Lennox. Frontenac, to Kingston, and Hastings and Addington, within thirty miles of the St. Lawrence River; also the southern portion of Victoria and Peterborough.

Varieties Recommended for Market:

European.—Bradshaw, Gueii, Imperial Gage, Lombard, Quackenboss or Glass, Yellow Egg, Reine Claude (Bavay), Monarch.

Japanese.—Burbank.

Varieties Recommended for Home Use:—

Washington, McLaughlin, Burbank, Bradshaw, Imperial Gage, Monarch, Reine Claude (Bavay), Shropshire Damson.

Counties of Leeds, Grenville, Dundas, Stormont.

Varieties Recommended for Market and Home Use:—

Americana and Nigra.—Aitkin, Bixby, Mankato, Omaha, Cheney, Wolf, Schley, Brackett, Hawkeye, Stoddard.

European, for trial in most favourable locations:—Early Red Russian, Lunn, Mount Royal, Raynes, Richland, Gueii, Glass, Arctic, Lombard, White Nicholas. Yellow Egg.

None of the European plums are very satisfactory in this district, as the fruit buds of most varieties are usually killed by winter.

Japanese Varieties.—Not hardy.

The counties of Victoria, Peterborough, Hastings and Addington, except the southern portions; Manitoulin and St. Joseph Islands, and the counties of Renfrew. Lanark, Carleton, Russell, Prescott, Glengarry.

Varieties Recommended for Market and Home Use:—

Americana and Nigra.—Earliest and best native seedlings, Aitkin, Bixby, Mankato, Omaha, Cheney, Wolf, Schley, Brackett, Hawkeye, Stoddard.

European, Suggested for Trial in Most Favourable Locations.—Early Red Russian, Rowley, Lunn, Mount Royal, Raynes, Richland, Glass, Montmorency, White Nicholas, Yellow Egg, Perdrigon, Ungarish. None of the European plums are very satisfactory in this district, as the fruit buds of most varieties are usually killed by winter.

Japanese Varieties.—Not hardy.

MOST NORTHERLY DISTRICTS.

Nigra.—Best early native seedlings, Aitkin, Cheney.

QUEBEC.

Counties of Pontiac, Wright, and Ottawa, south of latitude 46°, also the counties or Argenteuil, Two Mountains, Terrebonne, L'Assomption, and Montcalm, Joliette, Berthier, Maskinonge, and St. Maurice, within 25 miles of the St. Lawrence River.

Varieties Recommended for Market and Home Use:—

Americana and Nigra.—Earliest and best native seedlings, Aitkin, Bixby, Mankato, Omaha, Cheney, Wolf, Schley, Brackett, Hawkeye, Stoddard.

European, Suggested for Trial in Most Favourable Locations:—

Early Red Russian, Rowley, Lunn, Mount Royal, Raynes, Richmond, Glass, Montmorency, White Nicholas, Yellow Egg, Perdrigon, Ungarish.

None of the European plums are very satisfactory in this district, as the fruit buds of most varieties are usually killed by winter.

Japanese Varieties.—Not hardy.

Counties of Huntingdon, Beauharnois, Chateauguay, Jacques Cartier, Laval, Hochelaga, Chambly, Laprairie, Napierville, St. Johns, and the western part of Iberville and Missisquoi.

Varieties Recommended for Market and Home Use:—

Americana and Nigra.—Earliest and best native seedlings, Aitkin, Bixby, Mankato, Omaha, Cheney, Wolf, Schley, Brackett, Hawkeye, Stoddard.

For Trial or Home Use in Most Favourable Locations:—

European.—Queen May, Brodie, Perdrigon, Ungarish, Lunn, Mount Royal, Raynes, Montmorency, Arctic, Glass, Yellow Egg, Richland, Early Red Russian, White Nicholas, Lombard, Damson.

Japanese Varieties.—Not hardy, except in most favourable places.

Counties of Vercheres, Richelieu, Yamaska, St. Hyacinthe, Rouville, Bagot, Drummond, Richmond, Shefford, Sherbrooke, Brome, Stanstead, and the eastern part of Iberville and Missisquoi, and the western part of Compton.

Varieties Recommended for Market and Home Use:—

Americana and Nigra.—Best early native seedlings, Bixby, Mankato, Omaha, Cheney, Wolf, Schley, Hawkeye, Stoddard, Brackett.

European, for Trial and Home Use in Most Favourable Districts—Mount Royal, Raynes, Montmorency Glass, Richland, Early Red Russian, White Nicholas, Yellow Egg, Damson.

Japanese Varieties.—Not hardy.

Counties of Nicolet, Arthabaska, Wolfe, the eastern part of Compton, and the counties of Beauce, Megantic, Dorchester, Lotbiniere, Levis and Bellechasse.

Varieties Recommended for Market and Home Use:—

Americana and Nigra.—Best early native seedlings, Aitkin. Bixby, Mankato, Omaha, Cheney, Wolf, Schley, Brackett, Hawkeye, Stoddard.

European, Suggested for Trial and Home Use in Most Favourable Locations.—Mount Royal, Raynes, Montmorency, Lunn, Queen May, Early Red Russian, White Nicholas, Yellow Egg, Arctic, Ungarish.

Japanese Varieties.—Not hardy.

Counties of Montmagny, L'Islet, Kamouraska, most of Temiscouata, Bonaventure, and Gaspe, on the Bay of Chaleur side of Gaspe Basin.

Varieties Recommended for Growing near the St. Lawrence River:—

European.—Arctic, Washington, Bradshaw, Green Gage, Montmorency, Lombard, French Damson, Quackenboss, Grand Duke.

Additional Varieties Suggested.—Mount Royal, Raynes.

Varieties Recommended for Home Use:—

Mirabelle prècoce, Washington, Imperial Gage, Green Gage, Montmorency, Arctic, Lombard, French Damson.

Varieties Recommended for Growing Inland:—

Americana and Nigra.—Best early native seedlings, Aitkin, Bixby, Mankato, Omaha, Cheney, Wolf, Schley, Brackett.

Counties of Champlain, Portneuf, Quebec, Montmorency, Charlevoix. and Chicoutimi, east of the St. Maurice River, and southwest of Lake St. John and the St. Lawrence River.

Varieties Recommended.—Best early native seedlings, Aitkin, Omaha, Cheney, Bixby, Mankato, Brackett.

Near the St. Lawrence River, especially in the vicinity of Quebec and below and on the Island of Orleans, the following European varieties would give more or less satisfaction:—Washington, Green Gage, Arctic, Montmorency. Mount Royal, Raynes, Lombard, Damson.

North of latitude 46° as far as plums will grow; also the northeastern part of Temiscouata, Rimouski, and Matane.

Varieties Suggested.—Best early native seedlings, Aitkin, Odegard, Bixby, Mankato, Cheney, Omaha.

MANITOBA.

Varieties Recommended.—Cheney, Aitkin, Odegard, Assiniboine, and best seedlings of Manitoba native plum.

SOUTHERN MANITOBA.

Varieties Recommended.—Cheney, Aitkin, Odegard, Assiniboine, and best native seedlings; also Sand Cherry and Compass Cherries, which are more like plums than cherries. There are a number of promising varieties among Hansen's hybrid plums, such as Etopa, Hanska, Opata, Sapa, Kaga, and Owanka.

SASKATCHEWAN.

Varieties Recommended.—Cheney, Aitkin, Odegard, Assiniboine, and best seedlings of Manitoba native plum.

ALBERTA.

Varieties Recommended.—Best seedlings of Manitoba native plum, Cheney, Aitkin, Odegard, and Assiniboine.

BRITISH COLUMBIA: VANCOUVER ISLAND—SOUTHERN PART.

Commercial.—Most profitable: Englebert, Italian Prune. Others: Diamond, Pond, Golden Drop (Coe's), Grand Duke.

Additional Varieties for Domestic Use.—Peach, Washington.

LOWER MAINLAND.

Commercial.—Most profitable: Monarch, Italian Prune. Others: Bradshaw, Diamond, Golden Drop (Coe's), Grand Duke.

Additional Varieties for Home Use.—Peach, Green Gage, Imperial Gage, Washington.

DRY DISTRICTS, *including Lytton, Lillooet, Spence's Bridge, Kamloops, Okanagan Lake, Kettle River Valley.*

Commercial.—Most profitable: Italian Prune. Others: Bradshaw, Pond, Diamond, Gueii, Monarch, Grand Duke, Golden Drop (Coe's).

Additional varieties for Home Use.—Peach, Victoria, Yellow Egg.

WEST KOOTENAY.

Commercial.—Bradshaw, Pond, Diamond, Monarch, Grand Duke, Italian Prune, one of the most profitable.

Additional Varieties for Home Use Especially.—Peach, Washington, Victoria, and Reine Claude.

Japanese varieties succeed.

SHUSWAP LAKE DISTRICT.

Commercial.—Bradshaw, Yellow Egg, Gueii, Lombard, Pond, Italian Prune.

Additional Varieties for Home Use Especially.—Peach, Washington, Victoria, Reine Claude.

NEWER AND COLDER DISTRICTS.

Hardiest Varieties for Trial.—Arctic, Bradshaw, Gueii, Lombard, Yellow Egg, Quackenboss or Glass.

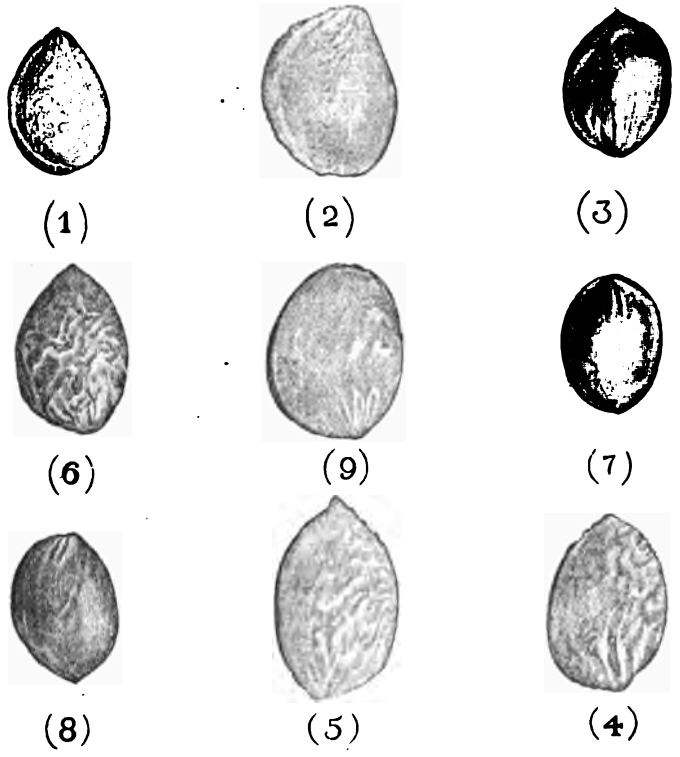
DESCRIPTIONS OF VARIETIES.

The following descriptions were, most of them, made by the author from specimens either grown at the Central Experimental Farm or in other parts of Canada. In some cases, however, especially among the European plums, the descriptions were obtained from other sources which are considered reliable. Where these descriptions are used the author's name is given. The varieties which are described are divided

into the various groups to which they belong. They are limited to those mentioned in the district lists, with the exception of a few new kinds considered promising, but which have not been tested long enough to recommend, and a few of the older varieties.

EUROPEAN VARIETIES.

Abegweit. Plum seedling from Henry E. Wright, Summerside, P.E.I.—Form round oval; size large; cavity medium depth and width; suture distinct, slightly depressed; apex slightly depressed; colour yellow, well covered with deep red; dots obscure; bloom, none on specimens received; skin moderately thin, rather tough; flesh yellow, juicy; stone medium to below, oval, flattened, cling; sweet, rich flavour, quality very good. A handsome plum and one worth testing. Raised from stone of a plum from California. Bore first time in 1903. Tree a fast grower. Ripens a few



Showing variations in stones of varieties of Americana plums: (1) Wolf, (2) Van Buren, (3) Voronesh Seedling, (4) Wyant, (5) Yosemite Yellow, (6) Yosemite Purple, (7) De Soto, (8) Rollingstone, (9) Hawkeye.

days later than Moore's Arctic and earlier than Lombard. Tree 6 to 7 years old from seed in 1903. Domestica group.

Agen.—A very old French variety of unknown origin.

'Fruit late, season short; one and one-half inches by one and one-eight inches in size, obovate, the base necked, halves equal, cavity shallow, narrow, flaring; suture very shallow, indistinct; apex roundish or flattened; color, reddish or violet-purple, overspread with thin bloom; dots numerous small, brown, obscure, clustered about the apex and interspersed between russet flecks; stem thick, seven-eighths inch long, glabrous, adhering well to the fruit; skin thin, tough; flesh greenish yellow, tender,

sweet, aromatic; very good to best; stone semi-free or free, seven-eighths inch by one-half inch in size, oval, flattened, with pitted surfaces, rather abrupt at the base and apex; ventral suture somewhat narrow, furrowed, with distinct wing; dorsal suture widely grooved.' (Plums of New York.)

The tree is an upright, spreading variety, and very productive, and one of the best for prunes though the fruit is rather small in some places.

Amaryllis (Seedling of Mirabelle).—Fruit above medium to large, roundish to heart-shaped; cavity medium depth and width, abrupt; stem medium to long, moderately stout; suture distinct, slightly depressed; apex rounded; colour greenish yellow; dots moderately numerous, indistinct; skin moderately thick, moderately tender; flesh yellow, juicy; stone medium size, oval, cling; sweet, rich flavour, quality very good. Grown from seed of Mirabelle in 1890. Began to bear in 1896. Tested September 30, 1912. Originated by Aug. Dupuis, Village des Aulnaies, P.Q.

Arctic (Moore's Arctic).—Fruit medium to below medium in size, roundish or somewhat oval; colour, dark purple, almost black; bloom thin, blue; suture indistinct; flesh greenish yellow, juicy, moderately sweet; quality medium; season early September. Tree vigorous and a good cropper. Hardier than some European plums, but not desirable where the best varieties succeed, as it is too small and not good enough in quality.

Bradshaw (Niagara?).—Fruit above medium to large, obovate; dark purplish red with a bluish bloom; dots few; cavity narrow, shallow; stem medium length moderately stout; suture distinct but shallow; apex rounded; skin rather thick, tough; flesh greenish yellow, juicy, moderately firm, sweet, with a rich flavour; stone semi-cling; quality good. Season middle of August to first week of September. Tree a strong upright grower, and very productive.

Brodie.—Fruit below medium size, almost round; colour, dark purple with a blue bloom; dots obscure; suture merely a distinct line; skin thin, tender, flesh greenish yellow, juicy, moderately firm, sweet, rich flavour; stone small, roundish, semi-cling; quality good to very good; season second and third weeks of September. A good dessert plum, but rather small for market. Specimens received from R. Brodie, Montreal, Que. Tree has been on Mr. Brodie's place since his grandfather's time. Thought to be a seedling.

Diamond.—Fruit medium to large, oval; colour, dark blue, and a heavy blue bloom; dots obscure; cavity narrow, abrupt; stem short to medium, rather stout; suture merely a distinct line, not depressesd; flesh yellow, moderately juicy; quality medium. Season medium. Tree a strong grower and very productive.

Early Red Russian.—Fruit medium size oval; cavity narrow, shallow, abrupt; stem medium length slender; suture an indistinct line, no depression; apex rounded; colour dull purplish red; dots moderately numerous, yellow, distinct; bloom thin, blue; skin fairly thick, moderately tender; flesh yellowish green, juicy; stone medium size, long, oval, cling; moderately sweet with an acid aftertaste; quality medium Season late September. Of the Lombard type. Imported from Russia by Prof. Budd from Dr. Regel, St. Petersburg, during the winter of 1881-2. Prof. Budd, writing in 1890, said of this plum: 'This was sent out quite extensively eight years ago marked "Mixed Arab." The sorts mixed were Early Red, White Nicholas and Black Arab.' Most of the trees proved to be Early Red Russian No. 3. There is still some doubt regarding this plum, which may be the variety sent out by Prof. Budd as White Nicholas. Another variety, called Late Red, somewhat like this one, which may be the true Early Red, ripens at Ottawa during the last week of August.

Emerald.—Fruit above medium size, oval; colour yellow; suture distinct; flesh yellow, juicy, sweet, good, rich flavour; stone free; quality good to very good. Specimens received on August 4th, from E. D. Smith, Winona, Ont. Said to ripen by the

end of July. Originated by the late Warren Holton, Hamilton, Ont. Has not succeeded well.

Engelbert.—A seedling of the 'Date Prune,' originating in Belgium, and of the prune type.

'Fruit mid-season, ripening period short; one and five-eighths inches by one and three-eighths inches in size; oval, swollen on the suture side, halves equal; cavity shallow, narrow, abrupt; suture a line; apex bluntly pointed or roundish; color dark purplish black, overspread with thick bloom; dots numerous, russet; stem three-quarters inch long, pubescent, adhering well to the fruit; skin thin, sourish, separating readily; flesh golden-yellow, juicy, coarse, rather firm, sweet, pleasant-flavoured, sprightly; good; stone one and one-eighth inches by five-inches in size, oval or broadly ovate, strongly flattened, with roughed and deeply pitted surfaces, blunt at the base and apex; ventral suture narrow strongly grooved, not prominent; dorsal suture acute, with a shallow, often indistinct groove.' (Plums of New York.)

Tree productive. A good shipping plum, and doing well in Western Canada.

Field.—A seedling of Bradshaw grown in Schoharie County, New York.

'Fruit mid-season, period of ripening short; one and seven-eighths inches by one and five-eighths inches in size; oblong-oval, compressed, halves equal; cavity shallow, narrow, abrupt; suture shallow, broad; apex roundish; color dark purplish-red, overspread with a very thick bloom; dots numerous, small, russet, clustered about the apex; stem three-quarters inch long, sparingly pubescent, adhering well to the fruit; skin thin, slightly sour separating readily; flesh greenish-yellow, medium juicy, sweetish, mild; of fair quality; stone clinging, one inch by five-eighths inches in size, ovate, with roughened and deeply pitted surfaces, blunt at the apex and base; ventral suture broad, distinctly furrowed; dorsal suture acute.' (Plums of New York.)

This variety has done well on Prince Edward Island, and appears hardier in flower bud than some other European varieties. The tree is of an upright-spreading habit and quite productive.

German Prune.—'Fruit small to medium; long oval; cavity very shallow; stem rather slender, medium long; suture hardly more than a line; apex somewhat pointed; colour blue; dots few, scattered; bloom blue; flesh greenish or slightly yellow; stone small, oval, pointed, moderately flattened, very free, quality hardly more than fair; season medium; tree strong, tall grower, productive.' (Waugh). This has long been a popular plum.

Glass (Glass seedling). Fruit large roundish, deep purple with a blue bloom; suture very shallow, indistinct; stem medium length, slender; flesh yellow with a shade of green, juicy, moderately sweet; skin medium in thickness, tender; stone medium size, cling; quality medium. Season, second and third weeks of September. Tree a strong grower and productive where it succeeds well. Very similar, if not identical with Quackenboss.

Golden Drop (Coe's Golden Drop).—'Fruit large to very large; oval with a short neck, the two halves unequal; cavity very shallow and abrupt; stem medium length, stout, suture deep; apex somewhat depressed; colour golden yellow; dots very many, yellow; bloom yellow; flesh firm, meaty; stone medium large, long, pointed, somewhat flattened, ribbed at the edge, half free; quality good; season medium late. Tree a good grower with large, coarse, rough foliage.' (Waugh).

Grand Duke.—'Fruit large to very large obovate; cavity narrow, shallow; stem an inch long; suture rather deep; colour very dark blue; bloom heavy, blue; flesh

yellow, firm; stone oval, hardly flattened cling; quality good; season late. Tree moderately vigorous with a spreading open head. Regarded by many as one of the very best late shipping plums.' (Waugh). This is a favourite plum in some parts of the best plum districts of Ontario.

Greenfield (seedling No. 1, from Samuel Greenfield, Ottawa East, Ont.).— Form roundish oval (broad); size large; cavity shallow; suture indistinct, no depression; apex rounded; colour dark purplish red; dots numerous, small, yellow; skin thin, tough; flesh greenish yellow, juicy, sweet; stone large, oval, cling; sweet, good flavour; quality good to very good. A plum of the Bradshaw type. Promising. Domestica group.

Gueii.—'Fruit medium size; oval, cordate; cavity shallow; stem an inch long, pubescent; suture shallow; apex somewhat pointed; colour blue; dots not visible; bloom blue; flesh greenish yellow; stone medium size, round oval, oblique pointed, cling; quality fair; season medium.' (Waugh).

Imperial Gage.—Fruit medium to above medium in size, roundish; colour yellowish green; dots indistinct; cavity narrow, medium depth; stem medium to long, moderately stout; suture distinct but very slightly depressed; skin fairly thick, rather tough; flesh yellowish green, firm, juicy, sweet, rich flavour; stone medium size, oval, semi-cling to almost free; quality very good. Season early September. Tree a strong grower and very productive.

Italian Prune (Fellenberg).—'Fruit medium to large, elliptical, straighter on one side and longer on the other; cavity very shallow; stem nearly as long as the fruit; suture shallow; colour dark blue; dots not many, dull yellow; bloom blue; skin thin; flesh greenish yellow; stone medium size, oval, pointed, rough, ridged at edge, quite free; quality good to extra; season late; tree rather spreading.' (Waugh).

This is one of the most satisfactory European plums both for home use and for market.

Jefferson.—'Fruit medium to large, round or round oval; cavity very shallow; stem medium short; suture, hardly any; apex very slightly depressed; colour greenish yellow; dots many, greenish; bloom white; skin thin and tender; flesh yellow; stone medium size, blunt, with a short neck, slightly flattened, rough, free; flavour, rich and sugary; quality good to best; season medium late; a good tree.' (Waugh), One of the finest varieties for home use.

Kingston Sugar, from R. A. Marrison, Cataraqui, Ont.—Heart-shaped; above medium size, 1½ by 1¼ inches; cavity shallow, medium width; stem medium length; moderately stout; suture a distinct line, very slightly depressed; apex rounded; green with traces of yellow; dots indistinct; bloom moderate, bluish skin moderately thick, moderately tough; flesh yellowish-green, juicy; stone medium size, oval, cling; flavour sweet, good; quality very good.

Said to be hardier than Lombard and some other sorts. A promising plum. Reine Claude group.

Lombard.—Fruit medium size, oval, slightly flattened at ends; colour purplish red with a thin blue bloom; dots fairly numerous, yellowish, distinct; stem short, slender; suture shallow, indistinct; skin rather thin, tender; flesh yellow, juicy, sweet, but not rich, firm; stone medium size, cling; quality medium; season second and third weeks of September. Tree vigorous and a very heavy bearer. One of the hardiest of the European plums.

Lunn (Montreal No. 60).—Fruit received from W. W. Dunlop, Outremont Que.). —Fruit large, oval, broad (round oval); cavity shallow, medium width, slightly flaring; stem medium length, ½-inch, stout; suture a distinct line, very little if any depression;

apex rounded, very slightly flattened; colour dark purple; dots fairly numerous, irregular, indistinct, brownish; bloom moderate, blue; skin moderately thick, tough; flesh yellowish green, very juicy, fairly firm; stone large, oval, cling; sweet, rich; quality very good. Season early to middle of September. A fine dessert plum.

Monarch.—'Fruit large, roundish oval; cavity deep, broad rounded; stem short and stout; suture hardly visible; colour dark purplish; bloom heavy bluish; flesh yellowish; stone free; quality good; season late. An English variety lately introduced into this country, and thought to be a valuable late shipping plum.' (Waugh). This plum is well worthy of trial.

Montmorency (Reine Claude de Montmorency).—Fruit medium size, almost round; cavity narrow, abrupt, rather shallow; stem short to medium, moderately stout; suture indistinct, sometimes very slightly depressed; apex rounded or slightly flattened; colour yellow and greenish yellow before quite ripe with a light orange blush or dots of orange on sunny side; dots obscure; bloom thin, white; skin moderately thick, tough; flesh yellow, very juicy, moderately firm, sweet, rich; stone small, oval, almost free; quality very good.

Mountain.—Fruit received from W. W. Dunlop, Outremont, Que.—Fruit medium to above medium size, roundish, flattened slightly at ends; cavity medium depth and width, slightly flaring; stem medium to long, moderately stout; suture distinct, usually slightly depressed; apex slightly flattened; colour greenish yellow, more or less overspread with dull coppery red; dots numerous, yellow, distinct; bloom thin, bluish; skin moderately thick, tough; flesh yellowish green; stone above medium, broad, roundish, cling; sweet, rich; quality very good. Season early to middle September. An excellent dessert plum. Well worth propagating.

Mount Royal (Dunlop 54).—Fruit received from W. W. Dunlop, Outremont, Que. Fruit medium size, roundish flattened at stem end; cavity medium to open, medium depth, somewhat flaring; stem short to medium, moderately stout; suture distinct, very slightly depressed; apex rounded, slightly flattened; colour dark purple; dots numerous, irregular, distinct; bloom blue, moderate; skin moderately thick, fairly tender; flesh greenish yellow, juicy, firm, sweet, moderately rich flavour; stone below medium, roundish, cling; quality good. Season early to mid-September. Should be a good shipping plum.

McLaughlin.—Fruit medium size, round or even oblate; cavity shallow, with a ridge around the stem; stem strong, rather long; suture very shallow; apex very slightly depressed; colour greenish yellow with a pink blush; dots many, greenish; bloom white; skin thin; flesh yellow; stone medium size, oblique oval, slightly flattened, rough, cling; flavour rich, sugary; quality extra. Season medium. Tree hardy and a fairly good grower. (Waugh.)

One of the best varieties for home use, the quality being exceptionally good. It is of the Green Gage type.

Peach.—'Fruit early; thick-set, without a neck; one and seven-eights inches in diameter; roundish, slightly angular, halves equal; cavity deep, wide, compressed; suture shallow, distinct; apex flattened or depressed, color dark purplish-red; overspread with thin bloom; dots numerous, large, conspicuous; stem eleven-sixteenths inch long, glabrous, adhering well to the fruit; skin tough, adhering; flesh golden yellow, medium juicy, firm, sub-acid, mild; good; stone free, one inch by three-quarters inch in size, roundish oval, flattened, with rough and pitted surfaces, blunt at the base and apex; ventral suture wide, prominent, often distinctly winged; dorsal suture with a wide, deep grove.' (Plums of New York.)

The Peach is an old variety of unknown origin. In Canada it is grown mainly on Vancouver Island and the Lower Mainland of British Columbia, where, though

very susceptible to rot, it succeeds very well. The tree is a very vigorous grower and moderately productive.

Peters (Peters' Yellow Gage).—Fruit medium to large; round oval; cavity medium, shallow, abrupt; stem long, pubescent; suture shallow; apex slightly depressed; colour greenish yellow, sometimes with a slight blush; dots many, yellow; bloom white; skin thin; flesh greenish yellow; stone medium, oval, pointed, hardly flattened; cling; quality good to best. Season early. Tree moderately vigorous and upright. A good amateur variety of the Green Gage type. (Waugh.)

This has succeeded well in District No. 3.

Pond (Pond's Seedling).—Fruit very large; nearly oval, but tapers slightly towards cavity; colour purplish red; bloom purplish; dots numerous, dull yellow, distinct but not prominent; cavity narrow, shallow; stem medium length, fairly stout; suture distinct and but slightly depressed; skin thick, rather tough; flesh yellow, juicy, sweet, good flavour; stone large, rough, cling; quality good. Season early September. Tree a strong grower and quite productive.

Quackenboss.—Fruit medium size or larger; round oval; cavity shallow, flaring; stem rather long; suture a line; colour blue; dots blue; bloom blue; skin thin; flesh greenish; stone oval, pointed, flattened, cling; quality fair to good. Season medium. A good rapid growing tree and fairly productive. (Waugh.)

Ripens in Ontario in second and third weeks of September.

Queen May.—Fruit large, roundish, almost perfectly round; colour greenish yellow splashed with pale green when not ripe; bloom thin, pale bluish; dots small, pale, indistinct; cavity narrow, medium depth; stem medium length to rather long, fairly stout; suture indistinct; apex rounded; skin moderately thick, tough; flesh greenish yellow, very juicy, moderately firm, sweet, rich flavour; stone medium size, almost oval, cling; quality very good; season September. Tree a strong, moderately spreading grower, fruiting heavily when young, but does not live very long. A very promising dessert plum. Specimens received from N. E. Jack, Chateauguay Basin, Que., who is growing trees received from Thos. Clark, Chateauguay. Thought to be a seedling.

Raynes (Dunlop 53).—Fruit received from W. W. Dunlop, Outremont, Que.—Fruit above medium to large; oval, long, flattened on side of suture; cavity medium depth and width, abrupt; stem medium length, moderately stout; suture distinct, slightly depressed; apex rounded; colour dark reddish purple; dots small, numerous, indistinct; bloom moderate, blue; skin thin, tender; flesh yellowish green, firm, fairly juicy; stone above medium to large, long, oval, free; moderately sweet; quality above medium. Season early to middle of September. A prolific bearer and should be a good shipper. A prune plum.

Reine Claude (Bavay).—Fruit large, roundish, slightly flattened at ends; colour greenish yellow with green splashes; bloom thin, pale; suture medium depth; stem short, stout; flesh yellow, juicy, melting, sweet, rich, very good flavour; stone free; quality very good; season late September to early October. Tree vigorous, very productive. One of the best both for home use and for market.

Richland.—Fruit medium to above medium size, oval; cavity narrow, medium depth, abrupt; stem medium length, ¾-inch, slender; suture a distinct line, no depression; apex rounded; colour deep purplish red; dots fairly numerous, yellow, indistinct; bloom moderate, blue; skin thick, fairly tender; flesh greenish yellow, juicy, moderately firm; stone medium size, oval, flat, cling; sweet but not rich; quality above medium. Season middle of September. Hardier than most European sorts. Originated on the farm of Randall Elden, Richland, Pennsylvania.

Rowley.—Fruit above medium size, round, dark purplish red with a bluish bloom; dots obscure; suture an indistinct line; apex rounded; skin thin, moderately tough; flesh yellow, moderately juicy, firm, sweet rich flavour; stone medium size, oval, slightly flattened, cling; quality good to very good. Season end of August and first week of September. A promising seedling originated by Jos. Rowley, Cummings Bridge, Ont. (near Ottawa). Said to fruit well nearly every year.

Shropshire (Damson).—Fruit small, oval, cavity, hardly any; stem about one-half inch long; suture none; colour dark blue; dots, none visible; bloom blue; skin firm; flesh greenish, sour; stone small, oval, turgid, cling; quality fair. Tree a good grower and enormously productive. (Waugh.)

This is a popular damson in Canada.

Splendor.—'Was originated by Luther Burbank in 1886 from a cross between Pond and Agen. In 1893 it was sold under the name Cross-bred Prune A.P.-318, to Stark Brothers, Louisiana, Missouri, who introduced it the following year under its present name. The fruit is twice the size of Agen, ovoid, compressed; dark purple; bloom heavy; flesh yellow, rich, sweet; freestone; hangs well to the tree, and ripens its crop all together.' (Plums of New York.)

Sugar.—A seedling of the Agen plum originating with Luther Burbank, Santa Rosa, Calif. 'Fruit intermediate in time and length of ripening season; small, ovate or oval, halves equal; cavity shallow, narrow, abrupt; suture shallow, often a line; apex roundish or pointed; colour dark reddish-purple changing to purplish-black, covered with thick bloom; dots numerous, small, light russet, inconspicuous; stem slender, long pubescent, adhering; skin thin, tender, separating readily; flesh golden yellow, juicy, coarse, fibrous, tender, sweet, mild, good to very good; stone light coloured, with a tinge of red, thin, of medium size, ovate, flattened, rough and pitted surfaces, blunt at the base, acute at the apex; ventral suture rather narrow, distinctly furrowed, slightly winged; dorsal suture with a wide, deep groove. (Plums of New York.)

Tree a vigorous, spreading grower and productive where it succeeds well. It is used quite extensively in prune making in the Pacific States, and has been planted to a limited extent in British Columbia.

Ungarish.—Fruit above medium to large; long oval; cavity narrow, shallow, abrupt; suture distinct, very slightly if at all depressed; apex round; colour dark purple; dots moderately numerous, indistinct, brown; bloom moderate, blue; skin fairly thick, tender; flesh greenish yellow, firm, fairly juicy; stone large, long, oval, free; moderately sweet; quality above medium. Season middle of September. Introduced by Prof. Budd from C. H. Wagner, Riga, Russia.

This plum is somewhat like the Raynes (Dunlop 53). A prune plum. Promising on account of hardiness.

Washington.—Fruit large, roundish, slightly flattened at ends; colour, greenish yellow with a pink blush on sunny side; dots obscure; cavity narrow, shallow; stem short, stout; suture distinct and slightly depressed; skin tough; flesh greenish yellow, firm, juicy, sweet, rich; stone medium size, roundish, almost or quite free; quality very good. Season early to mid-September. Tree a strong grower with a roundish top.

Yellow Egg.—Fruit large to very large, oval; colour deep yellow; bloom white; dots small, numerous, indistinct; cavity shallow, ridged; stem long, moderately stout, suture distinct, slightly depressed; skin thick, rather tough; flesh yellow, juicy, sweet; stone large, oval, cling; quality good. Season end of August to early September. Tree vigorous and productive.

JAPANESE VARIETIES.

Abundance.—Fruit large, roundish; bright to deep red with a yellow ground; dots numerous, yellow, prominent; cavity narrow, abrupt; stem medium length, rather stout; suture distinct; apex pointed; skin thin, moderately tender; flesh yellow, juicy, firm, sweet, rich; stone oval, cling. Quality good to very good. Season August 10 to 25. Tree a strong upright grower, an early bearer and productive.

Burbank.—Fruit large to very large, roundish; colour deep red with dark red on sunny side and about cavity, on a yellow ground; dots numerous, small, distinct, yellow; stem medium length; suture merely a distinct line; apex sometimes pointed; skin thin, moderately tender; flesh yellow, firm, juicy, sweet, good flavour; stone roundish, cling; quality good. Season latter part of August, a few days after Abundance. Tree an exceptionally vigorous grower, very branching, and bears early and heavily. One of the most, if not the most, satisfactory of the Japanese plums. The flower buds appear hardier than most European varieties.

Chabot.—Fruit medium to large, roundish, heart-shaped; colour deep, rather dull red; dots numerous, small, yellow; cavity narrow; stem short, stout; suture fairly distinct; apex usually rounded; skin moderately thick, tough; flesh yellow, juicy, firm, sweet; stone below medium size, oval, cling; quality good. Season late. Tree a strong upright grower and bears well. This variety is one of the later introductions and has proven one of the best of the Japanese plums.

Oyama (seedling of Red June).—Form roundish to broad oval; size medium; cavity narrow, medium depth, abrupt; suture a distinct line, not depressed; apex rounded; colour deep red all over; dots obscure; bloom thin, pale bluish; skin moderately thick, moderately tender, bitter; flesh yellow, firm, juicy; stone small, oval, cling; sweet, not of rich flavour; quality, medium to above medium. May be useful on account of hardiness of fruit buds. Triflora group. Originated at the Central Experimental Farm.

Red June.—Fruit medium to below in size, roundish, somewhat flattened; colour deep to dark red; dots small, yellow, numerous; cavity deep; stem short, moderately stout; suture distinct but shallow; skin thin, tender; flesh pale yellow, firm, juicy, briskly sub-acid with little richness; stone small, roundish, cling; quality medium. Season last week of July to first week of August. Tree moderately spreading. A medium bearer. This plum is valuable on account of its extreme earliness. This variety was received at the Central Experimental Farm under the name of Botan and Shiro-smomo. The flower buds are hardier than most European varieties, but although there is usually much bloom comparatively little fruit sets, probably because blossoms are self-sterile.

Togo (seedling of Red June).—Form roundish, somewhat heart-shaped; size above medium; cavity narrow, medium depth, abrupt; suture an indistinct, sometimes distinct, line, no depression; apex slightly flattened; colour deep red; dots numerous, small, indistinct; bloom moderate, bluish; skin moderately thick, tough; flesh yellow, firm, juicy; stone medium size, oval, slightly flattened, cling; sweet, acid next skin; quality good. A promising plum. Larger than Red June and better in quality. Handsome. Named Togo August 31, 1904, in honour of Admiral Togo. Triflora group. Originated at the Central Experimental Farm.

AMERICANA VARIETIES.

Alma (Caro seedling).—Oval; large, 1¾ x 1½ ins.; cavity narrow, abrupt, medium depth; stem slender, medium length, ½ in.; suture a distinct line, not depressed; apex rounded; yellow, thinly washed nearly all over with bright red; dots few, small, yellow; bloom thin, bluish; skin thick, tough; flesh yellow, juicy; stone above medium size, oval, flattened, cling; flavour sweet, rich, but skin slightly astringent and acid; quality good. Americana group. A handsome plum.

American Eagle.—Fruit above medium size, roundish; cavity narrow, medium depth; suture a fairly distinct line; apex rounded; colour deep purplish red; dots numerous, small, yellow; bloom moderate, pale blue; skin thick and tough; flesh deep yellow, juicy; stone medium size, oval, slightly flattened, cling; sweet, rich flavour; quality good. Season mid-September. Would be more promising if colour were brighter.

Assiniboin (seedling of Wild Plum of Manitoba, originating at the South Dakota Experimental Station).—An early, large fruited variety. Fruited and ripened at Indian Head, Sask., 1912.

Bender.—Fruit large, oval, slightly compressed; colour dark red; dots, very many, dull yellow; bloom thick, blue; cavity shallow; suture obsolete; skin thick, tough; flesh yellow; stone large, oval, flat, quite free; quality good; season rather early; tree very vigorous, with very large, fine healthy foliage; very productive. (Waugh.)

Planted at the Central Experimental Farm in 1900. Has been highly praised by some growers.

Bixby.—Fruit above medium to large, roundish; cavity narrow, medium depth; suture rather indistinct, slightly depressed; apex rounded; colour yellow, more or less covered with bright red; dots numerous, small, yellow; bloom fairly heavy; skin moderately thick, rather tender; flesh deep yellow, juicy; stone medium size, oval in outline, considerably flattened, cling; sweet but not rich in flavour, no astringency; quality good; season late August to early September.

A very handsome, early plum. Chief fault is unevenness of ripening. Makes good preserves.

Bomberger.—Form roundish to broad oval; size very large; cavity shallow, narrow; suture a distinct line; apex rounded; colour yellow, more or less covered with deep lively red; dots few, small, yellow, distinct; bloom medium; skin thick, tough; flesh deep yellow, juicy; stone medium size, oval, flat; sweet and rich; quality very good. A very handsome plum. More attractive than Hawkeye. Promising. Americana group.

Bouncer.—Fruit very large to large, roundish, somewhat heart-shaped; cavity medium width, shallow; suture a distinct line; apex pointed; colour uniformly deep, purplish red all over; dots numerous, yellow, distinct; bloom moderate; skin thick, tough; flesh deep yellow, juicy; stone large, flat, oval, cling; sweet, rich, very good flavour; quality very good; season mid to late September.

A seedling of Yosemite Purple, originated at the Central Experimental Farm.

A rather late variety.

Brackett.—Form roundish, flattened at ends; large to very large; cavity medium width, shallow; stem ½ inch, slender; suture a distinct line, no depression; apex flattened, indented; colour yellow almost entirely overspread with deep purplish red; dots numerous, yellow, distinct; bloom moderate, bluish; skin thick, tough; flesh deep yellow, meaty, juicy; stone above medium, roundish, flattened, cling; sweet, rich, good flavour; quality good.

Of the same character as Oren and Bouncer, but is better than either of them.

Caro.—Fruit large, roundish; cavity narrow, medium depth; suture fairly distinct; colour bright red, showing yellow in patches; dots numerous, yellow, distinct; bloom light; skin thick, moderately tender; flesh deep yellow, juicy; stone large, outline oval, considerably flattened; sweet, rich, good flavour; quality good; season early to mid-September.

A seedling of Wolf, originated at the Central Experimental Farm.

A promising seedling. More attractive than Wolf and better in quality.

City.—Fruit above medium size, roundish, somewhat heart-shaped; cavity medium width, deeper than most; suture a distinct line, slightly compressed; colour yellow, almost covered with deep red; dots numerous, small, yellow, distinct; bloom moderate; skin thick, moderately tender, slightly astringent; flesh deep yellow, juicy, sweet; stone medium size, oval, considerably flattened, semi-cling; quality good. Season mid-September. Among the good kinds, but quite a number are better.

Comfort.—Fruit medium size, roundish; cavity narrow, shallow; suture merely a distinct line; apex rounded; colour uniformly deep red all over; dots indistinct; bloom moderate; skin very thick, tough; flesh deep yellow, juicy; stone medium size, oval, considerably flattened, cling; sweet, good flavour; quality good. Season mid-September to October. A firm plum, but not large enough to be one of the best. Keeps better than most.

Consul.—Form large, roundish; cavity narrow, medium depth; suture a distinct line; apex rounded; colour deep red; dots moderately numerous, yellow, distinct; bloom light; skin rather thick, tough; flesh deep yellow, juicy, sweet; stone medium size, oval, considerably flattened, almost free; quality good. Season late September to early October. A seedling of Wolf originated at the Central Experimental Farm. Will probably prove a useful late plum.

Corona (Caro seedling).—Large; oval, lopsided; cavity medium size, shallow; suture slightly depressed, lopsided apex knobbed, irregular; greenish yellow overspread with bright red; predominant colour red; dots indistinct; bloom moderate; skin thick, tough, slightly bitter; flesh yellow to greenish yellow, firm, juicy, meaty, sweet, sprightly flavour; quality good; stone large, flattened, cling. Season late September. Originated at the Central Experimental Farm.

A very promising plum, large, of attractive appearance, of firm texture. Should prove to be a good shipper.

Cottrell.—Fruit above medium to large, oblong and roundish to heart-shaped; cavity narrow, medium depth; suture a distinct line; apex rounded; colour yellow, almost covered with bright red; dots rather numerous, small, yellow; bloom medium; skin moderately thick, tender; flesh pale yellow, juicy; stone medium size, oval, much flattened, cling; sweet, good flavour; quality good. Season early to mid-September. Promising, makes a good preserving plum and as attractive-looking.

One of the most promising seedling plums that fruited of those originated at Ottawa is a seedling of the Carp, which is a seedling of the Wolf; a description of this follows:—

Dara (Caro seedling).—Roundish to oval; large; cavity open, medium depth; suture a distinct line, very slightly depressed; apex rounded; colour, yellow, mottled and thinly washed with red; dots obscure; skin thick, moderately tender; flesh yellow, juicy; stone medium size, oval, almost free; sweet, pleasant flavour, skin acid; good quality. A good late plum. Originated at the Central Experimental Farm.

De Sota.—Fruit medium to above medium in size, roundish, somewhat heart-shaped, slightly flattened; cavity narrow, medium depth; suture a distinct line; colour deep yellow, well washed with deep red or dark red; dots obscure; bloom slight; skin moderately thick, fairly tender; flesh deep yellow, juicy; stone medium size, oval, considerably flattened, cling; sweet, good flavour; quality good. Season mid to late September. A good plum on account of its quality and great productiveness, but is not as large as it should be to be one of the best.

Don.—Fruit large, roundish; cavity narrow, medium depth; suture a distinct line; colour uniformly deep, lively red all over; dots numerous, small, distinct; bloom moderate; skin thick, tough; flesh deep yellow, juicy, firm; stone medium size, oval, somewhat flattened, cling; sweet, rich, good flavour; quality very good. Season late September to October. A seedling of Wolf, originated at the Experimental Farm. A very promising plum. One of the best late plums fruited here.

Dr. Dennis.—Fruit above medium to large, somewhat heart-shaped, flattened; cavity narrow, medium depth; suture a distinct line; apex rounded; colour deep red; dots small, numerous, distinct; bloom moderate; skin thick, rather tough; flesh deep yellow, juicy; stone large, flat, broad, cling; moderately sweet, slightly astringent; quality above medium. Season mid to late September. A good variety but not as promising as some.

Firmana (Consul seedling).—Large; oval, wedge, slightly lopsided; cavity medium to large, medium depth; suture indistinct; apex flattened, yellow, mottled and washed with carmine-red; predominant colour carmine-red; dots few, medium size, around apex; bloom moderate; skin medium thick; flesh yellow, firm, somewhat dry; sweet to insipid flavour; quality medium; stone large, bean-shaped, flattened. free; season late September. Originated at the Central Experimental Farm.

A plum possessing pre-eminently the characteristics of a good shipping fruit. Ten fruits weighed ten ounces.

Fitzroy (Rollingstone seedling)—Form roundish, slightly heart-shaped, flattened; size above medium to large; cavity narrow, shallow, abrupt; suture a distinct line, no depression; apex rounded; colour yellow, well washed with deep red; dots numerous, small, yellow, distinct; bloom moderate; skin thick, moderately tender; flesh rather pale, yellow, juicy; stone above medium size, flattened, roundish to oval, practically free; sweet; quality good. A good plum, but cracks some, which may be against it. Freeness of stone a good point. Americana group. Originated at the Central Experimental Farm.

Forest Garden.—Fruit medium size, roundish; cavity narrow, medium depth; suture a distinct line; apex rounded; colour yellow, almost entirely covered with dark purplish red; dots small, numerous, yellow; bloom moderate; skin thick, tough; flesh deep yellow, juicy, sweet; stone medium size to small, oval, considerably flattened, cling; quality good. Season early to mid September. Plum not attractive enough to be promising.

Gaylord.—Fruit above medium to large, roundish, somewhat heart-shaped; cavity narrow, shallow; suture a distinct line, very slightly depressed; apex pointed; colour deep, dull red on yellow ground; dots obscure; bloom moderate; skin thick, rather tough, slightly astringent; flesh deep yellow, juicy; stone medium size, oval, considerably flattened, semi-cling; sweet, good flavour; quality good. Season mid-September. Would be promising if colour were more attractive.

Gloria (Wolf seedling).—Form oval to oblong, somewhat flattened; size large; cavity narrow, shallow, abrupt; suture a distinct line; apex rounded; colour uniformly bright red all over, or yellow mottled with red; dots few, yellow, small, distinct; bloom thin, bluish; skin thick, tough; flesh deep yellow, juicy; stone large, almost or quite free, oblong, considerably flattened; sweet; quality good. Owing to its large size and the almost freeness of stone, this is a promising variety. Americana group. Originated at the Central Experimental Farm.

Hammer.—Fruit large, roundish to oval; cavity narrow, medium depth; suture a line, rather indistinct; colour uniformly deep red all over; dots numerous, yellow, distinct, prominent; bloom heavy; skin thick and tough; flesh deep yellow, juicy, meaty, sweet; stone below medium size, oval, considerably flattened, cling; quality good. Season late September. A very handsome plum having more the flavour of Miner than Americana. This variety cracks badly on the trees, otherwise it would be one of the most promising.

Hawkeye.—Fruit large, roundish; cavity shallow, narrow; suture merely a distinct line; apex rounded; colour yellow, more or less covered with purplish red; dots, small, indistinct; bloom medium; skin thick, moderately tough; flesh deep yellow, juicy; stone large, broad, much flattened, cling; sweet, good flavour. Quality good. Season mid to late September. One of the best.

Hazel (Gloria seedling).—Large; rounded ovate; cavity shallow, medium; suture indistinct, fairly clearly lined; apex rounded; yellow, generally entirely overspread with a dull, rich red; predominant colour dull, rich red; dots medium to large, distinct, yellow; bloom moderate; skin thick, tough, but agreeable; flesh golden yellow, juicy, moderately firm; sweet flavour; good quality; stone large, elongated ovate, flattened. Season mid-September. Originated at the Central Experimental Farm.

A very attractive plum of considerable promise.

Joseph (seedling from Joseph Rowley, Sr., Cummings Bridge, Ont.).—Form oval, flattened; very large; cavity shallow, medium width; suture a distinct line, not depressed; apex rounded, almost pointed; yellow more or less washed and mottled with attractive red; dots numerous, yellow, distinct; bloom medium; skin moderately thick, moderately tender; flesh yellow, juicy; stone above medium size, oval, almost free; flavour sweet, rich, good; quality very good for an americana plum.

An American plum of the largest size. Attractive in appearance and one of the best in quality. Very promising.

Came up in Mr. Rowley's garden in 1904. Bore in 1907 one plum. In 1908 two dozen plums. Measures 1½ inches around base 1908. No American plum trees near, but may have grown from a pit of American plum. September 24, 1908.

Kieth.—Form oval, somewhat heart-shaped; size above medium to large; cavity narrow, shallow; suture a distinct line, not depressed; apex rounded, almost pointed; colour yellow almost entirely covered with deep red; dots obscure; bloom light, lilac; skin thick, tough; flesh deep yellow, juicy; stone medium size, roundish, cling; flavour sweet, rich; quality good. Not as good as some others.

Kilmore (Yosemite Purple seedling).—Size large; form roundish, slightly flattened; cavity medium depth and width; suture a distinct line; colour bright purplish red; dots moderately numerous, yellow, distinct; bloom moderate; skin moderately thick, moderately tough; flesh deep yellow, juicy; stone above medium, oval, considerably flattened, almost free; sweet, rich, good flavour; quality good. Promising. Season medium late. Originated at the Central Experimental Farm.

Lester (De Soto seedling).—Roundish, one side a little longer than other; medium to above medium in size; cavity narrow, shallow; suture a distinct line only; apex rounded; yellow more or less covered with bright red; dots moderately numerous, small, yellow, rather indistinct; bloom moderate, bluish; skin moderately thick, rather tough; flesh deep yellow, juicy; stone below medium size, semi-cling, roundish, considerably flattened; sweet, good flavour; quality good. Season mid-September. Worth keeuping on account of quality and productiveness. A promising plum. Originated at the Central Experimental Farm.

Lottie.—Form roundish; size large; cavity shallow, narrow; suture an indistinct line; apex slightly flattened; colour yellow, mottled and washed with red; dots obscure; bloom slight; skin thick, tough; flesh sweet, juicy; stone medium size, roundish, semi-cling; sweet, rich; quality good. A handsome plum of good quality. Propagate. Americana group.

Major.—Seedling of Wild Plum of Manitoba, originated at the Experimental Farm, Brandon, Man. A very early variety of good quality, though rather small in size.

Mankato.—Fruit above medium to large, roundish; cavity narrow, medium depth; suture a distinct line; apex rounded; colour deep, dull red with a moderately heavy bloom; dots numerous, small, yellow; bloom rather heavy; skin thick, tough; flesh deep yellow, juicy, sweet, good flavour, not astringent; stone large, flat, semi-cling; quality good. Season late August to early September. Better in quality than Bixby, but not as handsome. A good early plum. Promising.

Marler (Caro seedling).—Roundish to oval; large for Americana, 1½ x 1½ ins.; cavity shallow, medium width; stem medium length, moderately stout; suture a distinct line, not depressed; stem more persistent than with most varieties; apex slightly depressed; yellow, covered with bright crimson; dots numerous, yellow, conspicuous; bloom pinkish; skin thick, but moderately tender; flesh yellow, firm, juicy; stone medium size, oval, cling; flavour sweet, rich, good, acid next skin; quality good. Americana group. Originated at the Central Experimental Farm.

A handsome plum, and on account of firmness and good quality should be useful. Hangs on tree well.

Milton.—Fruit medium to large, oval, bright to rather deep red; dots numerous, small, yellow, prominent; suture merely a distinct line; skin thin but tough; flesh yellow, juicy, sweet; stone medium size, cling; quality medium to good. Season last week of August. Tree a strong grower and very productive where fruit buds are not injured by winter. Wildgoose group.

New Ulm.—Fruit large, roundish, pointed or somewhat heart-shaped; cavity narrow, shallow; suture merely a distinct line; apex rounded, almost pointed; colour yellow, more or less covered with bright purplish red; dots numerous, small, yellow; bloom moderate; skin thick, tough; flesh deep yellow, juicy, sweet; stone medium size, oval, considerably flattened, cling; quality good. Season early to mid-September. A firm plum, and should make a good shipper. Too thick and tough in the skin for home use.

Oeheeda.—Fruit medium to above medium size, roundish to heart-shaped; cavity narrow, shallow; suture a distinct line; apex almost pointed; colour, deep red all over; dots numerous, small, yellow; bloom rather heavy; skin thick, moderately tender; flesh deep yellow, juicy; stone medium size, roundish, considerably flattened, cling; sweet, good flavour; quality good. Season early to mid-September. A firm plum and should ship well.

Queen (Golden Queen).—Fruit very large, roundish, oblong, bright golden yellow and of the most delicious flavour; quite unexcelled for canning, and very fine for eating out of hand or for slicing and serving with sugar and cream, as for peaches. Ripens latter part of August to September 10. Tree is remarkable for its unusually fine, upright growth. (Introducer's description.) Originated with H. A. Terry, Crescent, Ia. Has given good satisfaction elsewhere.

Schley, (Admiral).—Form roundish; size very large; cavity narrow, shallow; suture a distinct line; apex rounded; colour yellow, well washed with deep bronzy red; dots numerous, small, yellow, distinct; bloom thin, bluish; skin moderately thick, tough; flesh deep yellow, juicy; stone large, oval, flat, cling; sweet, of a rich flavour; quality very good. One of the best Americana plums yet tested. An improvement over Hawkeye. Americana group.

Silas Wilson.—Fruit large, roundish; cavity narrow, shallow; suture an indistinct line; apex rounded; colour yellow, more or less mottled with purplish red; dots very small, yellow, sparse; bloom medium; skin rather thick, moderately tender; flesh deep yellow, juicy; stone medium to above, roundish, broad, considerably flattened, semi-cling; sweet, rich, good flavour; quality very good. Season mid to late September. One of the best Americana plums.

Smith.—Form roundish to broad oval; size large; cavity narrow, shallow; suture a distinct line; apex rounded; colour yellow, mottled and washed with red; dots obscure; bloom light; skin thick, moderately tough; flesh yellow, juicy; stone rather large, oval, nearly free; sweet, rich; quality good to very good. A good plum. Promising. Americana group.

Stoddard.—Fruit large to very large, roundish; cavity narrow, shallow; suture a distinct line; apex rounded; colour deep yellow, almost entirely covered with deep purplish red; dots fairly numerous, small, yellow; bloom light; skin thick, tough, slightly astringent; flesh deep yellow, juicy; stone medium size, broad, flat, cling; sweet, good rich flavour; quality very good. Season late September. One of the largest and best flavoured Americana plums.

Sunrise.—Fruit large, oval; cavity narrow, shallow; suture a distinct line, not depressed; apex rounded; colour yellow, more or less covered with bright red; dots few, yellow, distinct; bloom medium, skin thick, moderately tough; flesh deep yellow, juicy, sweet; stone large, flat, oval; practically free; quality good. Season mid-September. A seedling of De Soto, originated at Central Experimental Farm. Promising owing to freeness of stone.

Swift (De Soto seedling).—Form broad oval, much flattened; size large; cavity narrow, shallow; suture merely an indistinct line; apex slightly flattened; colour yellow, mottled and washed with deep red; dots obscure; bloom slight; skin thick, moderately tough; flesh rather pale yellow, juicy; stone above medium, oval, semi-cling, almost free; flavour sweet, pleasant. A good plum and worth propagating. Americana group. Originated at the Central Experimental Farm.

Terry (Free Silver).—Fruit large, regular, oval; surface smooth but not shiny; colour a clear dark red; dots small, grey; bloom thin, lilac; cavity small, shallow; stem, ¾ to ½ inch; suture indistinct; apex rounded; skin thin, tough, acid but not astringent; flesh firm but melting; stone large, ovate, pointed; flattened, acid next to stone, adherent; flavour a mingling of Americana and Angustifolia; quality good. Season end of August. One of the largest and handsomest native plums yet produced. A very promising plum. (Craig.) Planted at Central Experimental Farm in 1902.

U.S.—Form roundish; large; cavity shallow, medium width; suture a distinct line; apex rounded; yellow almost entirely covered with deep purplish red; dots numerous, yellow, distinct; bloom moderate, bluish; skin thick, tough; flesh yellow, juicy; stone medium size, oval, cling; sweet, good flavour; quality good.

Of the same type as Oren and Bouncer, but not as good as either.

Van Buren.—Fruit medium to above medium size, almost round; cavity narrow, shallow; suture only a fairly distinct line; apex rounded; colour yellow, more or less mottled and washed with bright red; dots numerous, small, yellow; bloom light; skin thick, tough; flesh deep yellow, juicy, firm; stone above medium size, roundish, broad, much flattened, cling; sweet, good flavour; quality good. Season mid-September to October.

A handsome plum. One of the latest and best keepers.

Vesta (Gloria seedling).—Large to very large; oval; cavity medium to large, shallow; suture slightly depressed, fairly clearly lined; apex swollen opposite suture; yellow overspread by bright pink to dark. carmine red; predominant colour light, carmine red; dots medium to large, distinct, yellowish; bloom moderate; skin thick, slightly bitter; flesh yellow, juicy, firm, meaty; sweet, distinctive flavour; good quality; stone large, flattened, oval, nearly free. Season late September. Originated at the Central Experimental Farm.

One of the best. Ten fruits weighed 12 ounces. Attractive, large, firm, of good quality; skin somewhat tough.

Weaver.—Fruit above medium size, roundish, somewhat heart-shaped; cavity narrow, medium depth; suture a distinct line; colour yellow, nearly entirely overspread with bright red; dots numerous, small, purple; bloom light; skin moderately thick, tough; flesh deep yellow, juicy, sweet; stone medium size, oval, considerably flattened, almost free; quality good. Season mid-September.

An attractive plum, but not large enough to be promising.

Welcome (seedling of De Soto).—Fruit above medium size, oval, flattened considerably; cavity narrow, shallow; colour rich yellow more or less washed with red; dots very small, yellow, indistinct; bloom thin; skin moderately thick. fairly tough; flesh yellow, juicy, sweet, a pleasant but not rich flavour; quality good; season mid-September. A very handsome plum. Tree vigorous and productive. Originated at the Central Experimental Farm.

Whitaker.—Fruit large, oval, somewhat heart-shaped; colour bright red; suture merely a distinct line; dots numerous, yellow prominent; bloom thin, bluish; skin thin, tough; flesh yellow, juicy, moderately firm, sweet, good flavour; stone medium size, long oval, cling; quality good. Season first and second week in September, does not ripen evenly. A handsome plum. Tree vigorous, spreading and productive where fruit buds are not injured by winter. Wildgoose group.

Wolf.—Fruit large, roundish; cavity narrow, shallow; suture shallow, fairly distinct, not depressed; apex rounded; colour deep red; dots fairly numerous, small, yellow, distinct; bloom moderate; skin thick, tough; flesh deep yellow, juicy, sweet, rich, good flavour; stone above medium size, outline oval, considerably flattened, cling; quality good. Season early to mid-September. One of the best. This does not answer the description of Wolf given by some authorities. Both, however, are good plums.

Wyant.—Fruit large, oblong, flattened; cavity narrow, deep; suture a distinct line; apex almost pointed; colour deep red; dots numerous, small purple; bloom medium; skin rather thick, somewhat tough, astringent; flesh deep yellow, moderately juicy, fairly sweet; stone large, much flattened, oval, semi-cling, almost free; quality medium. Season mid-September. Quality not good enough. This plum is highly recommended in the Western States, but has not proven as good as some others here.

Yosmite Purple.—Fruit large, roundish, somewhat flattened; cavity medium depth and width; suture an indistinct line; colour deep, dull purplish red; dots numerous, small, yellow, distinct; bloom moderate; skin thick, but tender; flesh deep yellow, juicy; stone medium size, oval, considerably flattened, semi-cling; sweet, rich flavour, but somewhat astringent; quality above medium. Season mid to late September.

Yuteca (seedling of *P. Americana*).—Originated by N. E. Hansen, Brookings, S.D.

Tree hardy and a strong grower. Fruit roundish, large; cavity medium width, shallow; stem long, slender; suture a distinct line, not depressed; apex rounded; yellow, almost covered with lively crimson; dots numerous, yellow, distinct; bloom moderate, bluish; skin thick, moderately tough; flesh yellow, firm, juicy; stone medium size, roundish, semi-cling; flavour sweet, rich; quality good. Americana group.

An attractive-looking plum of good quality. Rather promising.

NIGRA VARIETIES.

Aitkin.—Fruit large, oval; cavity narrow, medium depth; suture obscure; apex pointed; colour uniformly deep red all over; dots none; bloom none; skin thin; flesh deep yellow, juicy, moderately sweet, not rich or high flavoured; stone large, flat, oval, semi-cling, no astringency; quality medium to above. Season, last week of August. Tree only fairly productive. Nigra group. The earliness of this plum is the principal point for recommendation.

Cheney.—Fruit large, round to somewhat oval, uneven; cavity narrow, medium depth; suture merely an indistinct line; apex rounded; colour uniformly deep red all over, sometimes paler on one side; dots none; bloom none; skin moderately thick, tough, not astringent; flesh deep yellow, juicy; stone medium size, flat, oval, cling; sweet, moderately rich flavour; quality good. Season late August to early September. One of the best. It soon gets soft, however, after ripening. Tree a strong grower, moderately productive. Nigra group.

Carstesen.—Fruit medium size, roundish, somewhat uneven; cavity narrow, medium depth; suture obscure; apex rounded; colour yellow, nearly covered with deep red; dots obscure; bloom none; skin thin, tender; flesh yellow, juicy, sweet, good flavour; stone flat, roundish, semi-cling, almost free; quality good; season early to mid-August. Tree vigorous, productive. The earliest native plum tested, and valuable on this account. A Nigra seedling, originated by H. P. Carstesen, Billings Bridge, Ont. (near Ottawa).

Rhoda (Cheney seedling).—Large; oval (regular); cavity broad, moderately deep to shallow; suture slightly depressed, faintly lined; apex rounded; dark red; predominant colour dark red; dots small, numerous, indistinct; bloom none to slight; skin fairly thin, tough, peels when ripe; flesh rich orange-yellow, firm, juicy; sweet, rich, pleasant flavour; good quality; stone broadly oval, dark colour, semi-free. Season mid-September. A good plum. Originated at the Central Experimental Farm.

Troy (Cheney seedling).—Roundish, large; cavity narrow, shallow; suture a fairly distinct line very slightly depressed; apex rounded; yellowish, well washed with deep red; dots numerous, small, yellow, distinct; bloom moderate, bluish; skin rather thick, moderately tender; flesh deep yellow, juicy; stone above medium, oval, flattened; sweet, good flavour; quality good to very good. Season mid September.

A promissing seedling, better in quality than Cheney. Originated at the Central Experimental Farm.

HYBRID VARIETIES.

America (*Prunus Munsoniana* x *P. triflora*).—Originated by Luther Burbank, Santa Rosa, Calif.

'Fruit early, season of medium length; one and three-eighths inches in diameter, roundish oval, halves equal; cavity shallow, flaring; suture shallow, a distinct line; apex roundish; color clear, dark, currant-red over golden-yellow, mottled, with thin bloom; dots numerous, small, whitish, inconspicuous; stem slender, one-half inch long, glabrous, adhering to the fruit; skin thin, bitterish, separating readily from the pulp; flesh yellow, juicy, fibrous, somewhat tender, sweet, not high in flavour; fair in quality; stone clinging, seven-eighths inch by one-half inch in size, oval, pointed, with pitted surfaces, broadly ridged along the ventral suture; dorsal suture grooved.' (Plums of New York.)

Tree strong, spreading grower and very productive. Has been found comparatively free from rot in New York State. Would be hardy only in the warmest parts of Canada.

Climax (*Prunus triflora* x *Prunus Simonii*).—Originated by Luther Burbank, Santa Rosa, Calif.

'Fruit very early, season short; one and three-quarter inches in diameter, cordate or roundish slightly compressed, halves unequal; cavity deep, abrupt, regular, marked with faint, reddish, radiating streaks; suture deep, broad; apex pointed; color dark red, mottled; bloom of medium thickness; dots numerous, variable in size, russet, conspicuous, clustered about the base; stem thick, nine-sixteenths inch long, glabrous,

parting readily from the fruit; skin thick, bitter, with a tendency to crack, separating easily from the pulp only when fully ripe; flesh yellowish, very juicy, somewhat fibrous, tender and melting, sweet, pleasant flavoured, aromatic; good; stone adhering, seven-eighths inch by five-eighths inch in size, somewhat long-oval, pointed, roughish, conspicuously winged and grooved on the ventral suture; dorsal suture slightly grooved.' (Plums of New York.)

A very handsome plum. It is succeeding well in Southwestern Ontario, but is not as productive as some others. The tree is a strong grower, but somewhat straggling in habit. Would be hardy only in the warmest parts of Canada.

Inpka (*Prunus americana* x *Prunus Simonii, Hansen*).—Globular, flattened; size medium, 1 1/16 x 1¼ ins.; cavity large, wide, fairly deep; suture distinct, depressed; apex slight, depressed; dark plum colour (i.e., dark crimson maroon); dots numerous, very distinct, whitish; bloom slight; skin thick, tough, but not astringent or bitter; flesh buff colour to whitish; stone small, cling; very rich, velvety, pear flavour, sweet and pleasant; quality good.

A very distinctive flavour which might be objected to by some people, otherwise a good plum for both dessert and culinary purposes.

Kaga (*Prunus americana* x *Prunus Simonii, Hansen*).—Somewhat heart-shaped, about size of Lombard or larger, 1½ x 1¾ ins.; cavity deep, abrupt, medium width; suture a distinct line, very slightly depressed; apex rounded; yellow, entirely overspread with deep crimson; dots numerous, yellow, distinct; bloom bluish; skin thick, tough; flesh greenish yellow, firm, juicy; stone below medium size, roundish, cling; quality above medium to good; sweet subacid, acid next stone and skin, spicey, pear-like flavour.

An attractive-looking plum with many Japanese characteristics. It is highly perfumed. Appears hardier in flower bud than most European plums. Should make a good shipping plum.

Mancheno (*Cheney* x *Manitoba Plum*).—Oval; size 1⅜ x 1⅛ ins.; cavity narrow medium depth, abrupt; stem medium length, ½ inch, slender; suture indistinct; apex rounded; yellow, almost entirely covered with deep red; dots obscure; skin moderately thick, moderately tough; flesh yellow, juicy; stone large, flat, cling; briskly subacid, somewhat astringent, little flavour; quality medium.

An attractive-looking plum, and earlier than Cheney. May be useful on this account. Cross by Dr. Wm. Saunders.

Omaha (*P. americana* x *P. triflora*).—Originated by Theodore Williams, Benson, Nebraska.

Tree hardy, a strong grower and productive. Fruit buds hardy. Fruit roundish, almost round; as large as largest Americana, 1½ by 1½ inches; cavity narrow, medium depth; stem short, ⅝-ins., moderately stout; suture an indistinct line, little, if any, depressed; apex rounded; yellow, entirely or almost entirely covered with attractive red; dots numerous, small, distinct; bloom bluish; skin moderately thick, tough; flesh yellow, juicy, tender; stone medium size, oval, cling; flavour sweet, good except next stone and skin, where acid; quality good except next skin.

Appears to be a blend of Americana and Japanese. Fruit has perfume of Japanese. Foliage of tree somewhat like Japanese.

Sapa (*Prunus Besseyi* x *Sultan, Hansen*).—Roundish somewhat heart-shaped; size 1⅛ x 1 in.; cavity open, deep, abrupt; stem slender, ¾ in. long; suture a distinct line; apex rounded or very slightly flattened; purple, washed with dark purple; dots numerous, very small, yellow, indistinct; bloom bluish, thin; skin thin, moderately

tough; flesh dark purple, very juicy; stone medium size, oval, cling; flavour briskly subacid, sprightly, acid next skin, slightly astringent; quality above medium.

Tastes a good deal like the better sand cherries, but is larger. Fruit buds evidently hardier than most Japan varieties.

Shiro (*Prunus Simonii* x *P. triflora* x *P. cerasifera* x *P. Munsoniana*).—Originated by Luther Burbank, Santa Rosa, Calif., and said to have in it the blood of the Robinson, Myrobolan, Apricot and Wickson plums.

'Fruit very early, season short; one and one-half inches in diameter, roundish-conic, with halves equal; cavity intermediate in depth and width, flaring, regular; suture an indistinct line; apex roundish; color light yellow becoming deeper yellow as the season advances, occasionally with a blush of pink, with thin bloom; dots numerous, very minute, whitish, inconspicuous; stem three-eighths inch long, adhering to the fruit; skin thin, tough, sour, occasionally cracking, separating readily although a thin coating of flesh is left clinging to the skin; flesh light yellow, semi-transparent, the stone being faintly visible, very juicy, fibrous, somewhat melting, sweet, mild, lacks character in flavour; good; stone clinging, seven-eighths inch by five-eighths inch in size, broadly oval, flattened, slightly elongated at the base, with rough surfaces; ventral suture faintly ridged and furrowed; dorsal suture very slightly grooved.' (Plums of New York.)

The tree is a strong grower of an upright, spreading habit and productive where it succeeds well, but it is too tender except for the warmest parts of Canada.

Toka (*Prunus americana* x *P. Simonii, Hansen*).—Fruit roundish to heart-shaped; below medium in size (1 x 1⅛ inches); cavity narrow, medium depth, abrupt; stem medium length, slender; suture an indistinct line, very slightly depressed; apex rounded; colour yellow entirely covered with deep red; dots very small, indistinct; bloom thin, pinkish; skin moderately thick, tough; flesh yellow, juicy, moderately firm; stone medium size, oval cling; sweet with a peculiar aromatic, pleasant flavour, acid next skin and pit. Quality good. Season mid-September. A decided and rather unusual flavour. Not large enough to be very promising unless very hardy.

Tokeya (*Sand Cherry* x *Chinese Apricots, Hansen*).—Roundish, almost oblate, flattened at ends; size 1 x 1¼ ins.; cavity deep, medium width; stem moderately stout, ½-inch long; suture an indistinct line, slightly depressed; apex flattened; dark red; dots indistinct; bloom thin, bluish; skin thin, moderately tender; flesh greenish, juicy; stone medium size, roundish, cling; acid, bitter flavour; quality below medium. Hybrid group.

Not at all agreeable to eat on account of bitterness.

Wickson (*Prunus triflora* x *P. Simonii*).—Originated by Luther Burbank, Santa Rosa, Calif. He considered it a cross between Kelsey and Burbank, but it is thought by others to have the blood of Prunis Simonii.

'Fruit early mid-season, period of ripening long; variable in size, the larger fruits about two and one-eighth inches in diameter, obliquely cordate, halves unequal; cavity deep, abrupt, with yellowish concentric rings; suture often prominent and deep, with a prolonged tip at the apex; colour dark red over a yellow ground, indistinctly splashed with darker red, mottled with thin bloom; dots numerous, small, yellow, inconspicuous, densly clustered about the apex; stem thick, eleven-sixteenths inch long, glabrous; skin thin, tender, separating easily; flesh amber-yellow, juicy, coarse, somewhat fibrous, firm, sweet, pleasant but not high in flavour; good; stone clinging, one inch by five-eighths in size, oval or ovate, pointed, with pitted surface; ventral suture winged; dorsal suture grooved.' (Plums of New York.)

Varieties of Plums which are being tested at the Central Experimental Farm, Ottawa.

List of Varieties.

Names of Varieties.	Date of Planting Oldest Trees.
European Plums.	
Abegweit	1905
Amaryllis	1902
Arab	1898
Arctic (*Moore's Arctic*)	1899
Baker Prune	1899
Beauty of Naples = Naples	
Benedict	1906
Bejonnieres	1901
Bohemian	1893
Bonne Ste. Anne	1895
Bradshaw	1899
Brodie	1903
Canada Orleans	1898
Chatauqua	1899
Columbia	1898
Cochet père	1901
Communia	1906
Czar	1900
Denniston Superb	1902
Diamond	1900
Duane (*Duane's Purple*)	1895
Early Red Russian	1895
Emerald	1903
Empire	1900
Englebert (*Prince Englebert*)	1898
Favorite Hative	1908
Fellenberg = Italian Prune	
Field	1900
General Hand = Hand	
German Prune	1895
Glass (*Glass Seedling*)	1898
Grand Duke	1898
Greenfield	1905
Green Gage	1899
Gueii	1898
Hand (*General Hand*)	1898
Hanszwetsche	1900
Horrigan	1903
Ickworth (*Ickworth Imperatrice*)	1901
Imperial Gage	1900
Italian Prune (*Fellenberg*)	1898
Janne très hative de Babond	1908
John A	1895
July Green Gage (*Reine Claude hative*)	1908
Kingston	1900
Krikon	1913
Lachine	1903
Latchford	1907
Leipsic	1893
Lincoln	1900
Lombard	1900
Lunn	1903
McLaughlin	1900
Mallard	1903
Mirabelle précoce de Floton	1908
Moldavka (*Blue Moldavka*)	1895
Moldavka (*Yellow Moldavka, Voronesh*)	1897
Monarch	1900
Monroe	1901
Montmorency (*Reine Claude de Montmorency*)	1899
Moore's Arctic = Arctic	
Mount Royal	1903
Mountain	1903
Naples (*Beauty of Naples*)	1900
Niagara (*Bradshaw 1*)	1898

Names of Varieties—*Continued.*	Date of Planting Oldest Trees.
European Plums—*Continued.*	
Outremont	1903
Pauline Schleiter	1904
Perdrigon	1903
Pond (*Pond's Seedling*)	1900
Prince Englebert = Englebert	
Quackenboss	1898
Queen May	1903
Quebec	1902
Raynes	1903
Red Egg	1898
Reine Claude de Montmorency = Montmorency	
Reine Claude dorée	1906
Richard Trotter	1895
Richland	1888
Rowley	1903
Saratoga	1901
Shropshire (*Shropshire Damson*)	1898
Smith's Early	1897
Spanish King	1906
Smith's October	1897
Tatge	1903
Ungarish	1888
Voronesh Blue	1903
Voronesh Yellow	1893
Wangenheim	190[illegible]
White Nicholas	1895
Yellow Moldavka = Moldavka	
Victoria	1895
Japanese Plums.	
Abundance	1900
Berckman's	1903
Botan = Red June	
Burbank	1900
Chabot	1903
Engre	1903
Hale	1903
Kerr	1903
October (*October Purple*)	1903
Red June	1894
Satsuma	1903
Shiro-Smomo = Red June	
Willard	1900
Americana Plums.	
Admiral Dewey	1901
Admiral Schley	1901
Advance	1903
Alma	1907
American Eagle	1895
Anderson	1907
Atkins	1907
Bailey	1903
Bender	1900
Bixby	1893
Blackhawk	1893
Bomberger	1901
Bouncer	1895
Brackett	1903
Brittlewood No. 1	1901
Brittlewood No. 2 = U. S.	
Brittlewood No. 3	1903
Brooklyn	1903

List of Varieties.—*Concluded.*

Names of Varieties—*Continued.*	Date of Planting Oldest Trees.
Americana Plums—*Continued.*	
Bryan (*W. J.*)	1903
Budd (*Prof.*)	1903
Caro	1895
Champion	1895
City	1895
Coinage	1903
Colorado (*Colorado Queen*)	1895
Colman	1901
Comfort	1893
Consul	1895
Cook Choice	1906
Corona	1907
Cottrell	1895
Craig (*Prof.*)	1903
Cyclone	1901
Dara	1913
Deepcreek	1895
Dennis (*Dr.*)	1895
De Soto	1888
Diana	1901
Don	1895
Dunlap (*Dunlap's No. 1*)	1895
Eldorado	1901
Emma	1901
Etta	1901
Firmana	1907
Fitzroy	1907
Forest Garden	1890
Freestone	1901
Free Silver = Terry	
Galena	1895
Gaylord	1895
Gloria	1907
Golden	1903
Golden Queen = Queen	
Hammer	1895
Hanson	1901
Hawkeye	1898
Hazel	1909
Holt	1901
Hunt	1893
Irene	1895
Ironclad	1895
Jessie	1894
Jewell	1913
Joseph	1913
Julia	1901
Kennedy Red	1897
Kickapoo	1900
Kieth	1903
Kilmore	1909
Lambert (*Lambert's Red*)	1897
Large Red Sweet = Plunk	
Leatherskin	1907
Legal Tender	1901
Leonard	1897
Lester	1909
Lillie	1901
Lottie	1901
Louisa	1901
Mankato	1895
Marcellus	1901
Marjorie	1903
Marler	1907
Mary	1901
Maude Lacey	1903
Mollie	1901
Moon	1899

Names of Varieties—*Continued.*	Date of Planting Oldest Trees.
Americana Plums—*Concluded.*	
Nellie	1895
Nellie Blanche	1901
Newton Egg	1897
New Ulm	1895
Ocheeda	1895
Old Gold	1897
Omega	1901
Pearl	1901
Peffer Premium	1895
Plunk (*Large Red Sweet*)	1897
Purple Yosemite (*Yosemite Purple*)	
Quaker	1895
Queen (*Golden Queen*)	1901
Reel	1901
Rockford	1892
Rollingstone	1888
Ruby	1903
Sada	1901
Silas Wilson	1895
Smith	1901
Speer	1888
Stella	1903
Stoddard	1891
Sunrise	1895
Swift	1907
Terry's De Soto	1903
Terry (*Free Silver*)	1902
U. S. (*Brittlewood No. 2*)	1901
Value	1903
Van Buren	1890
Van Deman	1895
Vesta	1909
Warren	1901
Weaver	1895
Welcome	1907
Wolf	1888
Wyant	1890
Yellow Americana	1907
Yellow Sweet	1895
Yosemite Purple = Purple Yosemite	
Yuteca	1907
Nigra Plums.	
Aitkin	1897
August	1899
Brandon Ruby	1903
Carstesen (*Earliest*)	1906
Cheney	1890
Gopon	1907
Manitoba No. 4	1895
Manitoba No. 5	1895
Mills Seedling	1890
Odegard	1901
Rhoda	1907
Smith Red	1900
Snelling	1894
Victor	1907
Whyte	1893
Miner-like Plums.	
Bestovall	1906
Carver	1895
Clinton	1895
Col. Wilder = Wilder	
Esther	1895
Forest Rose	1898

List of Varieties—*Continued.*

Names of Varieties—*Continued.*	Date of Planting Oldest Trees.
Miner-like Plums—*Concluded.*	
Idall (*Idol*)	1895
Iroquois	1895
Miner	1895
Nebraska	1895
Oren	1900
Prairie Flower	1895
Rachel	1897
Surprise	1900
Wier (*Wier's Large Red*)	1895
Wayland-like Plums.	
Benson (*Mollie*)	1901
Golden Beauty	1895
Moreman	1888
Reed	1895
Wildgoose Plums.	
Downing (*Charles*)	1893
Dunlop (*No. 2*)	1895
James Vick	1897
Milton	1893
Roulette	1899
Sophie	1895
Van Houten	1901
Whitaker	1895
Wilder (*Col.*)	1901
Wildgoose	1898
Hybrid Plums.	
America (*Botan x Robinson*)	1901
Ames (*P. americana x P. triflora*)	1901
Apple (*Parentage unknown*)	190'
Bartlett (*Delaware x P. Simonii*)	1901
Bursoto (*Burbank x DeSoto*)	1913
Chalco (*P. Simonii x Burbank*)	1903
Cheresoto (*P. Besseyi x DeSoto*)	1911
Climax (*Botan x P. Simondii*)	1901
Combination (*P. triflora x ?*)	1903
Composs Cherry (*Prunus Besseyi x Miner*)	1901
Doris (*Parentage unknown*)	1903
Duke (*P. Munsoniana x ?*)	1903

Names of Varieties—*Concluded.*	Date of Planting Oldest Trees.
Hybrid Plums—*Concluded.*	
Excelsior (*Kelsey x Wildgoose*)	1903
Ezaptan (*P. Besseyi x Sultan*)	1913
First (*Parentage uncertain*)	1903
Fourth of July	1913
Freeche	1910
Golden (*Gold*) (*Robinson x Botan*)	1903
Goosedye (*Wildgoose x Dyehouse cherry?*)	1903
Gonzales (*Parentage unknown*)	1903
Hanska (*P. amercana x P. Simonii*)	1909
Holland (*Kelsey x Lone Star*)	1903
Inkpa (*P. americana x P. Simonii*)	1909
Kaga (*P. amercana x P. Simonii*)	1909
Kelbalan (*Kelsey x Early Cherry*)	1903
Kelmyro (*Kelsey x Early Cherry*)	1903
Mancheno (*Cheney x Manitoba Plum*)	
Nona (*P. triflora x P. angustifolia ?*)	1903
Occident (*Parentage unknown*)	1903
Omaha (*Abundance x Brittlewood*)	1906
Opata (*P. Besseyi x Gold*)	1913
Oyama (*Red June x P. americana ?*)	1907
Pendent (*Pottawattamie x Forest Garden*)	1901
Preserver (*Kelsey x Early Red ?*)	1903
Ragland (*Kelsey x Yellow Transparent*)	1903
Red Glass (*Miner x Quackenboss*)	1907
Red May (*Abundance x Wildgoose*)	1903
Rupert (*Prunus pumila x P. americana*)	1901
Sansoto (*P. Besseyi x DeSoto*)	1911
Sapa (*P. Besseyi x Sultan*)	1909
Scarlet (*Wildgoose x Cheney*)	1907
Shiro (*Robinson x Myrobalan x Wickson*)	1901
Six Weeks (*Abundance x Chickasaw*)	1903
Sultan = Occident	1901
Togo (*Red June x P. americana ?*)	1906
Watson (*Kelsey x Lone Star ?*)	1903
Waugh (*Chabot x Wayland*)	1903
Wickson (*P. triflora x P. Simonii*)	1903
Yates (*Kelsey x Lone Star ?*)	1903
Toka (*P. americana x P. Simonii*)	1911
Tokeya (*P. Besseyi x P. Simonii*)	

POLLINATION OF PLUMS.

Until recent years the pollination of fruits was given comparatively little study, but during the past twenty years a number of experimenters have been at work investigating the causes of failure in the setting of fruit and have shown the importance of having the blossoms fertilized by pollen which will ensure the setting of the fruit. The plum has received more careful study in regard to pollination than any other fruit. For five years or more Prof. F. A. Waugh gave this question his special attention, and the results which he obtained and the facts which he published have been of great assistance to fruit growers.

As a result of his experiments he found that of all the varieties of plums of American origin which he studied (and he studied most of those on the market), only one variety, the Robinson, was self-fertile. In other words, if a tree of any other

Cheney Plum. (*Prunus nigra.*)

variety of American origin than the Robinson were planted where its flowers could not be fertilized by the pollen from a tree of another variety no fruit or practically no fruit would set. The Japanese plums were almost as self-sterile as the American but the European plums were more or less self-fertile. It will be seen from the above that many varieties of plums are not fertilized at all or only partly fertilized by their own pollen. It is necessary, therefore, that varieties be so mixed in the orchard that proper pollination and a good setting of the fruit will be ensured. Americana varieties of plums should be planted to pollenize Americana varieties, Nigra to pollenize Nigra, although Americana will do, Japanese to pollenize Japanese and

Americana Plum. (*Prunus americana*).

European to pollenize European. Varieties should be planted near each other which bloom at the same time. This is very important, as if the varieties do not bloom at the same time pollination cannot take place. The nurserymen do not as a rule give in their catalogues the relative time of blooming of the different varieties bought from them, but it is necessary for the fruit grower to know this before planting if he is to obtain the best results. The value of bees and other insects in the orchard for assisting in pollenizing the flowers cannot be over-estimated, and where possible, colonies should be kept for this purpose.

The dates of blooming of plums in different parts of Canada were recorded by fruit growers for the Horticultural division of the Central Experimental Farm for five years. These dates have been compiled and the average of each variety thus obtained. The following is a table of varieties of Americana and Nigra plums recommended in this bulletin, giving their season of blooming. This will be of assistance to fruit growers when planting. A table of the European varieties is not given, as the

European Plum. (*Prunus domestica*).

information obtained was not full enough to be perfectly reliable, and furthermore, the intermixing of European kinds is not so important as with American, as most of the varieties appear to be self-fertile. The Japanese varieties described in this bulletin are all extra early and early bloomers, and will thus pollenize one another.

There is ten days' difference between the time of blooming of the earliest and latest varieties in the following table, so that it would be impossible for the early blooming varieties to pollenize the late ones, but the early might pollenize the medium,

and the medium the medium late. The pistils or female organs of the plum blossoms often mature first, often as much as four days before the anthers containing the pollen. The stigmas may remain in condition to receive the pollen for several days. As pollen is not all shed at the same time, the difference in time of maturity of pistil and anthers is not so important as it otherwise would be.

AMERICANA AND NIGRA PLUMS—SEASON OF BLOOMING.

Extra Early.—Aitkin.

Early.—Cheney, Mankato, Odegard.

Medium.—Bixby, Admiral Schley, Omaha.

Medium Late.—Brackett, Wolf, Hawkeye, Stoddard.

PRUNING.

The pruning of the trees is not nearly as important in the culture of the plum as of the apple, and there is more danger of injury by over-pruning than too little pruning. While an apple tree will, as a rule, recover from severe pruning, plum trees often never recover from it. In plum culture it is much better to err on the side of under-pruning than over-pruning. The tree should be pruned when young to a symmetrical top with the main branches so disposed that there will be no bad crotches, after which very little pruning is necessary beyond cutting out dead and broken branches and thinning out where the top is very thick. Some varieties will require more pruning than others, some of the Japanese being especially rampant growers. There is a difference of opinion and a difference of results in regard to the heading back of plum trees. As a rule, very good results will be obtained without heading back. A few strong growing varieties, such as Burbank, however, have to be kept cut back to keep them within reasonable limits, and some of the Americana varieties will break down in winter unless headed back. When trees are headed in, the work should be done early in the spring, at which time the ordinary pruning can be done to best advantage. Wounds should be covered with lead paint or grafting wax.

The following note on useful fertilizers for the plum orchard has been prepared for this bulletin by the Chemist of the Experimental Farm.

FERTILIZERS FOR THE PLUM ORCHARD.

By Frank T. Shutt, M.A., *Dominion Chemist.*

In common with other orchard crops, the requirements of the plum tree, as regards plant food, are chiefly nitrogen, phosphoric acid, and potash, and these essential elements must be present not only in fair quantities but in more or less readily available forms if vigorous growth and an abundance of fruit are to be expected. In addition, lime is frequently of value, since all stone fruits make a considerable demand upon the available lime of the soil, and this, owing to natural causes or exhaustive cropping, may be reduced to mere traces.

Further, all rational systems of fertilization must include the renewal, from time to time, of the vegetable organic matter of the soil, and this may best be attained when the supply of barnyard manure is insufficient, by the growth and turning under of green crops.

Nitrogen and Organic Matter.—Since these, from an agricultural point of view, are intimately associated the one with the other, the latter being the natural conservator of the former, and economy, as a rule, dictating their use in orchards in such an associated form, we may conveniently consider their application under the same heading.

Barnyard manure undoubtedly stands first on the majority of farms of enriching the soil in these constituents and improving its physical condition. In composition—and hence in value—it is extremely variable, but good average samples of fresh manure may be considered to contain: nitrogen 0·5%, phosphoric acid 0·25%, potash 0·45%. The organic matter in fresh manure is usually in the neighbourhood of 25%.

With many orchardists, however, the available supply of manure is insufficient and inadequate for the area to be fertilized, and it is for such that the system of green manuring—as by the growth and turning under of a cover crop—is especially valuable. The important role of the cover crop in the modern systems of orchard soil management is set forth in another place in this bulletin and the whole subject of increasing fertility by means of clover has been very fully explained in Bulletin No. 40 of the Experimental Farms series. It will, therefore, only be necessary here to state one or two of the principal reasons why clover or some other of the legumes should be employed for this purpose of enriching and improving the soil.

A vigorous crop of clover will contain at a moderate estimate, in its foliage and roots:—

Nitrogen	from 100 to 150	lbs.	per acre.
Phosphoric acid	" 30 to 45		"
Potash	" 85 to 115		"

It is evident, therefore, that by this use of clover we can with a single crop furnish the soil with as much nitrogen as would be supplied by a dressing of 10 tons of manure per acre. The greater part of this nitrogen is taken by the clover from the atmosphere, and hence is a distinct addition to the soil. The phosphoric acid, potash and lime, it is true, have been obtained from the soil, but have largely been drawn from a considerable depth and hence increase the stores of these elements in the upper layers of the soil. Moreover, the decay of the clover sets free all these important elements of plant food in forms readily utilizable by trees.

One or two words should also be added regarding the value of the organic matter so supplied. This eventually is converted into humus, the importance of which as a soil constituent it is difficult to over-estimate. It not only liberates slowly and continuously its plant food, but vastly improves the soil texture, whether it be a clay or a sandy loam. It increases the soil's power for absorbing and retaining moisture and it furnishes the best material for the development of microbic life, which, as now known, plays so important a part in increasing a soil's fertility.

There is, of course, a possibility of too great an enrichment with nitrogen by this means; this would be indicated by luxurious and excessive growth, dark-green foliage and poor fruiting. Under such circumstances, the use of organic and nitrogenous fertilizers should be discontinued.

To furnish immediately available nitrogen to young trees showing a deficiency of this element (indicated by a sparse development of foliage of a yellowish-green colour), nitrate of soda may be used as a top dressing, at the rate of 100 to 200 lbs. per acre.

Phosphoric Acid, Potash and Lime.—There is probably no better medium for supplying these elements to orchard soils than unleached hardwood ashes. These should contain from 5 to 6 per cent of potash, in the neighbourhood of 2 to 3 per cent of phosphoric acid, and from 30 to 35 per cent of lime. Not only are these constituents in wood ashes in a condition that renders them readily assimilable, but in

many parts of Canada they are cheaper than in any other form of commercial fertilizer. Fifty to eighty bushels per acre is the usual application.

Bone meal should contain from 3 to 4 per cent of nitrogen, and 20 to 24 per cent of phosphoric acid. Since its plant food is only slowly liberated in the soil, it is considered a 'lasting' fertilizer and one well adapted to orchard use. The application is usually about 300 lbs. per acre. Superphosphate will contain from 15 to 20 per cent of phosphoric acid, the greater portion of which should be in a soluble (available) condition. The application is from 200 to 400 lbs. per acre.

Potash can be obtained in the form of muriate (50 per cent actual potash) or as kainit (12 per cent actual potash); 100 to 150 lbs. of the former and 200 to 500 lbs. of the latter are the limits for ordinary application.

Voorhees, in his work on fertilizers, suggests the following mixtures for orchards: (*a*) one part, or 100 lbs. each, of ground bone, superphosphate, and muriate of potash; and (*b*) a mixture of one and a half parts, or 150 lbs., of ground bone and one part, or 100 lbs., of muriate of potash.

Soils differ so greatly as to their fertility that it is impossible to state definitely the amounts of these fertilizers that could in all cases be used with profit. From 300 to 500 lbs. of such mixtures per acre on fairly good soils would, no doubt, be ample, but on very poor soils these amounts, according to the experience of many orchardists, might be considerably increased.

Lime.—Where lime only is required, by reason of natural deficiency in this element, the excess of humus, soreness, or the refractory character of the soil, it may be applied at the rate of 1 to 2 tons per acre.

CULTIVATION.

Plum orchards should be kept under a high state of cultivation or otherwise the fruit is likely to be small. The plum requires a large amount of moisture. The surface soil should be stirred about once a week or after every heavy rain until July in order to conserve moisture and to open the soil so that the air can get in freely and assist in nitrification and help promote a thrifty growth of the trees. Trees sometimes produce good crops of plums when they are growing in sod but this is not the rule. It has been found that there is more than twice as much moisture when the ground is cultivated than where there is sod. Furthermore, the curculio becomes very troublesome in sod orchards, and for this reason, if for no other, the orchard should be kept cultivated. Cultivation should be discontinued towards the middle of July, in order that the wood may ripen in good time and that a good cover crop may be established. Where trees are planted close and cultivation is difficult it will be preferable to mulch the trees with grass or straw than to leave them in sod, as the fruit will be larger and the trees more thrifty.

COVER CROPS.

A cover crop is a crop of some kind the seed for which is planted for the purpose of having a growing crop in the orchard after cultivation has ceased, in order to help use up plant food which has been made available during the summer and which might leach away if the soil were bare. A more important purpose still of this crop, especially in some localities, is to have a covering which will protect the roots of the trees and help to hold the snow in winter. A third important use of the cover crop is to have some vegetable matter to plough under in the spring to improve the soil both by adding humus and by adding nitrogen where leguminous plants are used.

Experiments with cover crops have been carried on rather extensively at the Central Experimental Farm for the past eighteen years, and it has been found that

the most satisfactory plant for this purpose is the common red clover, sown not later than the middle of July at the rate of 10 to 12 lbs. per acre, no nurse crop being used as a rule. The hairy vetch (*Vicia villosa*) has given good satisfaction in some places, especially in the Niagara peninsula, and has the advantage of growing very late in the autumn. This may be sown at the rate of 40 or 50 lbs. per acre with good results. The seed of the Summer Vetch or tares is much cheaper, and where it succeeds may be planted instead. Where it is not especially desired to add nitrogen to the soil, rape makes a good cover crop if sown at the rate of from 4 to 6 lbs. per acre. It is not necessary that the plant used as a cover crop should live over winter.

Sometimes it is not possible, owing to dry weather, to get a good cover crop by sowing about the middle or latter half of July. Experiments at the Central Experimental Farm were made to learn how satisfactory plants in drills two feet or more apart would prove as cover crops. The object of planting this way is that the seed may be sown early enough to ensure a good crop and yet the soil be cultivated until the usual time. Soja beans, horse beans, and hairy vetch were used for this purpose. This method is said to have given good satisfaction where it has been tried. If the soil suffers from lack of moisture in a dry time, the cover crop should be ploughed under as early in the spring as possible and cultivation begun. By doing this, much of the moisture which would otherwise be transpired through the leaves of the growing plants would be conserved.

PICKING, PACKING, STORING AND MARKETING THE FRUIT.

Experience only will teach the fruit grower the proper time to pick each variety of plum for storing or shipping, as some may be picked greener and some riper than others. As a rule, however, the European plums should be picked when they are well coloured but still quite firm. It is particularly desirable to pick those varieties which are subject to rot, a little on the green side. The Americana varieties are so juicy that they also have to be picked before fully ripe if they are to be shipped far. The Japanese varieties may be picked earlier than either of the preceding as the colour and flavour will develop well even though harvested when rather on the green side. Plums should be picked with the stems on when it is possible to do so, and on no account should they be shaken from the tree when intended for shipment. A step-ladder to stand on and a strong basket to put the fruit in are necessary. Plums are usually sold in medium sized fruit baskets, the six quart baskets being preferred. It is sometimes advisable when the fruit is especially fine to face the basket, thus giving the fruit a still more attractive appearance, but if this is done the face should represent the kind of fruit to be found lower down. Some varieties of plums will keep for several weeks in cool or cold storage. A temperature of from 36 to 42 degrees Fahrenheit has been found the best for storing this fruit.

The marketing of the plums will depend very much on the location of the orchard. The greatest care should be observed to have the fruit reach the market in prime condition, and if it is consigned to a commission merchant he should be one of recognized integrity.

Thinning the Fruit.—Until quite recent years the thinning of plums on the trees had not been practiced very extensively. Plum orchards have increased so much, however, in size and number that the competition has been keener and the prices lower, and in consequence the most advanced growers are now thinning their fruit, and find it profitable to do so, as the prices obtained for the larger fruit more than compensate for the labour required in thinning. Furthermore, if part of the fruit is picked when green it does not have to be picked when ripe, so there is little extra handling. Some varieties of plum trees bear very heavily, and this is particularly true of the Americana varieties. In consequence, the fruit when unthinned is much

smaller than it would be if there were less of it, and the drain upon the vitality of the tree from the production of so much seed shows itself before long, and it frequently happens, especially in poorly tilled and poorly fertilized orchards, that trees literally bear themselves to death.

The time to thin is after the fruit is well set and when it is fairly certain what the crop is going to be. There is always a dropping of plums during the month of June, caused principally by improper pollination, natural thinning and injury from curculio, and as soon as possible after these have thinned the crop, hand thinning should be done. The Americana plums fruit so heavily, that in an experiment conducted at the Wisconsin Experiment Station, it was found that nearly four-fifths of the crop should be removed in order to get really satisfactory results. When Americana plums were thinned as heavily as this the fruit was left about two inches apart, which was found a good distance in the experiment, but a greater distance was suggested. Experiments in thinning Americana plums at the Central Experimental Farm resulted in the thinned fruit when ripe being considerably larger than that unthinned.

Some varieties of European and Japanese plums are left as much as six inches apart by fruit growers, and at this distance profitable crops are said to be obtained of fruit of the best quality. From one-fourth to one-half the crop should be removed in thinning. The most profitable distance apart to leave the plums will be largely governed by the variety. Some varieties will not need thinning at all, and even where trees are bearing heavily, the scarcity and cost of labour may prevent the profitable thinning of the fruit.

PRUNES.

While prunes are not likely to be manufactured commercially on a large scale in Canada, it will be of interest to readers of this bulletin to know something of how they are made.

A prune is a dried plum. Some varieties of plums, owing to the small proportion of juice, are especially adapted to be manufactured into prunes. There are several varieties, somewhat like one another, known as the Prune group. Among these may be mentioned the Italian Prune (Fellenberg), German Prune, Agen, and Raynes. California and Oregon manufacture most of the prunes made in America. The dry districts of British Columbia are very suitable for the production of prune plums, but it has not been found profitable to manufacture them for several reasons. The price of labour and fuel are too high, and there is a larger proportion of moisture in the plums than in those grown in California or Oregon. In California, a large proportion of the prunes are made by drying them in the sun. Another method is to dry them in evaporators. The plums are not harvested until they are ripe enough to fall to the ground. They are graded first of all, to ensure evenness in curing, and then are either dipped in lye for about a minute or pricked by needles in a pricking machine in order to allow the moisture to escape. After this they are rinsed, and then subjected to a temperature of 120°F. to 140°F. at first and then to temperatures ranging from 160°F. to 180°F., the temperature being lowered when the prunes are being removed. It requires from one to four days to dry them, depending partly on how large the plums are. If the plums are not thoroughly cured, they are liable to mould and ferment. Considerable experience is necessary to ensure a good grade of prunes. After they have gone through the evaporator, they are piled in order that they may sweat, which takes from one to three weeks. After this they are graded and packed.

CANNING AND PRESERVING AMERICAN PLUMS.

All good housewives are familiar with the way to can and preserve European plums, but the American varieties require different treatment in order to get the

most satisfactory results. Some varieties are thick in the skin, while others are more or less astringent, and for these reasons special methods are employed to make the fruit more palatable. The skin of many varieties may be readily removed by pouring boiling water on the fruit and then peeling it. Preserves made from fruit thus treated is very good. The skin of some varieties will not break down in cooking, and peeling is especially desirable in such cases.

American plums are not as good for canning as the European, and, if they are canned, are best for making pies.

The following eight varieties of American plums were preserved, in order to learn what differences there were in these kinds for this purpose:—Bixby, Cheney, New Ulm, Mankato, Cottrell, Bouncer, American Eagle, Silas Wilson. These were preserved with and without the skin. In nearly every case the peeled fruit made the best preserves. The Bixby, however, cooked with the skin on was the best of all those tested, having a better flavour than any of the others both peeled and unpeeled. With some varieties 1 lb. of sugar to 1 lb. of fruit was found to make the preserves too thick; on the other hand, ¾ lb. sugar to 1 lb. of fruit, in some cases did not make them quite sweet enough. None of the varieties tested were found markedly astringent, though most of those cooked with the skins had a flavour, not unpleasant, but peculiar to the American plums. The proper proportions to be used in preserving each variety will have to be learned by experience. The following are some of the notes made on the preserves, arranged in descending order of merit:—

Bixby.—1 lb. sugar to 1 lb. fruit, unpeeled; good colour, good flavour, skin tender.

Cheney.—1 lb. sugar to 1 lb. fruit, peeled; attractive amber colour, good flavour.

Cottrell.—1 lb. sugar to 1 lb. fruit, peeled; amber colour, sweet, rich, good.

New Ulm.—1 lb. sugar to 1 lb. fruit, peeled; attractive, pale, good flavour.

Mankato.—1 lb. sugar to 1 lb. fruit, peeled; pale, clear amber, good flavour, but too sweet.

Bouncer.—1 lb. sugar to 1 lb. fruit, peeled; attractive, but too thick, good flavour.

Bixby.—1 lb. sugar to 1 lb. fruit, peeled; too sweet, not as good as unpeeled.

Cottrell.—¾ lb. sugar to 1 lb. unpeeled fruit; attractive colour, not as good as peeled.

Silas Wilson.—1 lb. sugar to 1 lb. fruit, peeled; dull amber colour, good, but too rich.

Bouncer.—¾ lb. sugar to 1 lb. fruit, unpeeled; attractive colour, good flavour, but skin tough.

Mankato.—1 lb. sugar to 1 lb. fruit, unpeeled; fairly attractive colour, but too sweet.

New Ulm.—1 lb. sugar to 1 lb. fruit, unpeeled; attractive colour, good flavour, but tough skin.

Silas Wilson.—1 lb. sugar to 1 lb. fruit, unpeeled; good flavour, but skin tough.

American Eagle.—¾ lb. sugar to 1 lb. fruit; deep red, rather tough skin, medium quality.

Cheney.—1 lb. sugar to 1 lb. fruit, unpeeled; unattractive colour, but skin breaks well.

The following recipes for canning and preserving American plums, published by the late Prof. Goff, of the Wisconsin Experiment Station, were consulted and in part adopted in making the preserves:—

"The native plums, especially those with firm pulp, after being treated by any of the methods mentioned below, are well adapted to all purposes for which the foreign

plums are used. As a rule, more sugar is required for the native plums, but the preparations are rich in proportion. The harshness in the skin and stone of some native plums is readily removed by steaming them in an ordinary cooking steamer until the skin cracks; or pour over them boiling water to which has been added common baking soda in the proportion of half a teaspoonful to a quart. The thicker skinned varieties may be readily peelel by placing them in boiling water two or three minutes. The recipes follow:—

Canning.—Pick the fruit when well coloured but a little hard, steam or cook in a porcelain-lined kettle until tender, put in cans that have first been treated to boiling water, and cover with boiling syrup made of equal parts of granulated sugar and water, filling the can to the top; then run a silver knife around the can inside and let out the air, and seal at once. Plums cooked in the syrup are likely to be tough. Canned plums may be used for pies and for mixing with or flavouring other fruit. Plums are often canned without sugar to be used in winter for making fresh plum butter. The juice of canned plums makes excellent jelly. One lady recommends splitting native plums to the stone on one side before cooking, to avoid crumbling.

Drying.—De Soto, Wyant, and doubtless other varieties, may be pared, pitted and spread on plates, lightly sprinkled with sugar and dried, first in the oven and later in the sun. Cook like dried peaches.

Plum Jelly.—The fruit should be gathered when only part ripe—about half coloured. This point is very essential. Put plums in a large granite or porcelain kettle—the latter is best—with barely enough water to cover them. Cook until tender, but not until they are in a pulpy mass. Having previously covered a large jar with a cloth, strain the fruit in and let the juice drop through, but do not squeeze. When all has drained through, strain once or twice more through another cloth, until the juice is perfectly clear. To one measure of juice provide one measure of granulated sugar, but do not put together at once. A very important point in the making of all jelly is that only a small quantity should be cooked at one time. In a medium sized kettle put, say, four tumblers of juice, let it boil briskly fifteen or twenty minutes, then add the four tumblers of sugar, and in a very short time, usually from three to ten minutes, the jelly will be finished, light, clear and delicious. To test the jelly, dip a spoon into the boiling juice and sugar and hold it up; when the jelly clings to the spoon in thick drops, take it off quickly and put into jelly glasses. The plum pulp which is left can be put through a cullender and used for plum butter.

Another recipe. *Plum Preserves.*—Take equal weights of fruit and sugar, place in stone jar a layer of fruit, then a layer of sugar, alternating thus until quantity desired is reached. Let stand over night; in the morning drain off the syrup that will have formed, into a porcelain kettle, place same over a fire and let syrup come to a boil, then pour it over fruit in jar again; repeat this every day until the fourth heating, when fruit and syrup are both put in kettle and boiled for a few minutes. Place same in glass jars while hot, seal and put away in some cool and preferably dark place.

Still another recipe.—To each pound of plums add a pound of sugar, put the fruit into boiling water until the skins will slip; peel and sprinkle sugar upon each layer of fruit in a bowl, allowing them to stand over night, then pour off the juice, bring quickly to a boil, skim and add the plums, cook very slowly till tender and clear, which will take about one-half hour; take them out carefully and put into a pan, boil the syrup for a few minutes longer until it thickens, pour it over the fruit, seal or tie them up.

The following recipe for preserving Cheney plums which would, no doubt, be a good one for other varieties, was furnished the writer by Mrs. Dora M. Robson, Ottawa, Ont., whose jam made from the Nigra or Americana plums was the best we have ever eaten.

"The plums were not quite ripe, being partly red and partly yellow. No ripe or all red plums were used, and to this is attributed part of the success of this formula. The fruit was weighed and put into a preserving kettle at the back of the range, a few of the plums being crushed. The fruit was left here until the slow heat drew the juices out, then the preserving kettle was drawn forward and the plums cooked slowly until they were thoroughly done. One pound of heated sugar was then added to one pound of the fruit, including stones and skin. The fruit was then left on the range just long enough to be sure all the sugar had melted and boiled up once, probably about three minutes. No water was put with the plums."

The skin of the plums in the jam had apparently dissolved, and one would scarcely know but that the skin had been removed before preserving, which was not the case.

Another good native plum jam was sent to us by A. E. Wilson, Clarence, Ont., ably about three minutes. No water was put with the plums."

SPRAYING.

It should not now be necessary to point out the advantages of spraying to control insect enemies and fungous diseases, as so much has been said and written on this subject. The beneficial results where spraying has been thoroughly done and the conditions have been favourable have also been so marked that the advantages of spraying need no further proof. It is, however, found necessary to continually advocate this practice. Fruit growers become discouraged after an unfavourable season for spraying, when the conditions are favourable for the development of fungi and rainy weather prevents the application of mixtures altogether or which if applied are washed off by the rain almost as soon as the work is done. With an experience of this kind fruit growers are often inclined to stop spraying and let Nature take her course. It sometimes happens, however, that the mixtures and solutions have been improperly made or the wrong mixture has been used to destroy a certain insect or disease and the fruit grower wonders why he does not get good results. It is more frequently the case, however, that the spraying is not thoroughly done. The object of spraying is to cover the leaves, fruit and bark with the fungicides and insecticides in order that the latter may destroy the insects or diseases which come in contact with them, and in order that the materials may be distributed evenly over the tree it should be forced out of the pump in a fine mist-like spray, to accomplish which it is necessary to have a good nozzle. If the trees are not covered with the mixtures and solutions at all times when the insects and diseases may be affected by them, the trees and fruit may be injured just in proportion to the thoroughness and continuity with which the work is done. It is, therefore, important that every fruit grower should know the life history of every insect and disease which injures his trees or fruit, in order that he may know the best time to spray for each enemy. A spraying calendar has been published at intervals at the Central Experimental Farm, in which are given full directions for the preparation of the different formulæ recommended and the time when each spraying should be made. These calendars are of great value to fruit growers and should be in the hands of everyone. Although a certain number of applications are recommended for the prevention and control of the different insects and diseases referred to, it may be necessary to make more. If, for instance, a heavy rain came on, say, within 24 hours after a spraying had been made, which washed most of the material off, another application should be made as this might be the very time when the disease or insect which it is desirable to control is making the greatest headway. It is often too late, also, when a spraying for a certain purpose is made, and labour and material are thus practically lost. Spraying is rather expensive when there is a large orchard to cover. It is, therefore, very important that the right mixtures and solutions are used; that they are prepared properly and applied thoroughly, constantly

and at the right time, and that the trees be kept covered with the mixtures and solutions during all the time when injury is likely to occur.

As the mixtures and solutions may have very injurious effects on the trees if improperly made, and as they may prove of little or no value if not applied at the right time, the formulæ recommended in this bulletin should be closely followed.

DISEASES OF THE PLUM.

RIPE ROT, BROWN ROT, *Sclerotinia (Monilia) fructigena.*—The ripe rot causes serious injury to the plum crop every year in some parts of Canada. Its spread is so rapid that a fine crop of plums is soon rendered almost worthless. The disease is usually first noticed on the ripening fruit by a discoloration of the skin, which becomes brown or black and is soon covered by small pustules or clusters of spores, the fruit rotting and falling to the ground. If the weather is damp and sultry the conditions are most favourable to the rotting of the fruit, and a large proportion of the crop will be destroyed in one day. Sometimes the disease does not show when the fruit is picked, and infected fruit is shipped and rots before reaching its destination, causing serious loss to shipper or buyer. This disease is often not recognized in the spring, at which time it attacks the twigs, fruit spurs and blossoms, causing them to blacken and wither. At this time, also, there is often an exudation of gum from the twigs and spurs, brought about by this disease.

Remedies.—The ripe rot fungus spreads by means of spores which germinate early in the spring and penetrate the twigs from the leaf and flower buds on which they alight. In order to destroy as many of these spores as possible all diseased fruit should be gathered and burned whether it is on the ground or on the tree. This fruit harbours myriads of spores, which endure the winter and are capable of infecting the trees the following spring.

The trees should be thoroughly sprayed in time to destroy the spores before they germinate in the spring. The first spraying should be made with poisoned Bordeaux mixture or lime sulphur wash, shortly before the flower buds open. This is an important spraying, and should be very thorough. After the trees have bloomed they should be thoroughly sprayed again with poisoned Bordeaux mixture, and again in about two weeks. The trees should also be sprayed with ammoniacal copper carbonate when the fruit is beginning to ripen. This will destroy the spores which appear in great numbers on the mature plums, and not discolour the fruit. Plums which touch one another on the tree give very favourable conditions for the spread of the disease from one fruit to another. Being close together, moisture is retained on the skin and the spores which may be on one fruit germinate readily and soon infect the next, and thus the disease spreads rapidly. Thinning the fruit would make the conditions much less favourable for the development of the disease. All discoloured or dead wood should be cut out and burned in the meantime. If spraying is thoroughly done the injury from this disease should be much lessened; but sometimes, unfortunately, the results do not seem to justify the expenditure in endeavouring to control this disease by spraying.

BLACK KNOT (*Plowrightia morbosa*).—The black knot is more feared by some fruit growers than almost any other disease. Its development appears to them mysterious and its control impossible. Many orchards have been completely ruined by the black knot, which spreads very rapidly once it has gained a foothold in the orchard. If trees are treated properly and well looked after from the outset it may be kept in check and even eradicated altogether, if infection does not take place from neighbouring orchards or from planting trees from infected nurseries.

The black knot is a fungus which spreads by means of spores. A spore is blown through the air and alights in the axil of a leaf, on a spur, or on some other part of

the tree where it can get a resting place. When conditions are favourable the spore germinates, penetrates the tree and grows in it. In the spring yellowish swellings appear on the branches, the first visible indication of the disease, and during the months of May and June become darker in colour with a velvety surface which is caused by innumerable spores which cover the exposed part of the lump or knot. These spores are soon blown away and alight on other branches and trees. These germinate and penetrate the tree as already described and new knots develop in time from them. A second crop of spores is produced in autumn or early winter, but these are not liberated from the knot until the latter part of the winter or early in the spring when they are distributed, and alighting on the trees germinate as the others. The mycelium is not all exhausted by the production of the knots in spring, but is capable of producing more from the same knot the following year. The disease is also liable to be carried from one orchard to another, which makes it difficult to control sometimes. To fight a disease which is provided with such sure means of reproduction and dissemination requires watchfulness, thoroughness, and continuous effort until it is eradicated.

Remedy.—If the trees are already badly affected with this disease the best plan is to cut them down and burn them. If moderately affected, the knots should be removed and burned and the orchard thoroughly cultivated and sprayed. Vigorous trees are not so subject to the disease as those making little growth, and vigorous trees will recover more quickly from wounds made by removing the knots.

As the early spores appear in the latter part of spring or early in summer, the knots should be removed as soon as possible after they appear. When they are on small branches these should be cut off three to six inches below the affected part and burned immediately. When this is not practicable without badly injuring the tree the knot should be removed with a sharp pruning knife and the wound given a thorough painting with pure kerosene, after which it should be covered with grafting wax or lead paint. Great care should be taken to prevent the kerosene running on the branch as it may injure it. Old knots which cannot be removed with the knife should get a good painting with kerosene. By putting some colouring material in the kerosene, one can more readily see when a wound has been painted well. All knots should be burned. The treatment already described is only for the knots. Unless the life history of this disease is known a fruit grower might imagine that if the knots were removed as they appeared that it was all that was necessary. This might be all, if the knots were removed before the spores were formed and distributed, but if one knot were missed it would be capable of producing myriads of spores which would soon re-infect the orchard.

The advantages of spraying with Bordeaux mixture were clearly demonstrated in an experiment conducted at the Cornell Experiment Station, the results of which were published in Bulletin No. 81 of that station. It was found that the number of knots was reduced from 2,000 to 165 by spraying.

A large proportion of the late spores which are exposed in late winter or early spring and are ready to germinate when conditions are favourable, would probably be destroyed by an application of lime sulphur wash or Bordeaux mixture when the trees are still nearly dormant in the spring. A second spraying of poisoned Bordeaux mixture should be made just as or before the buds are breaking, which would also be a good time to spray for other diseases of the plum and for insects, and a third spraying should be made at the time when the knots are at the velvety or spore producing stage in order to destroy these spores. A fourth application would also probably be well worth the expense. Every precaution should be taken to prevent the spread of this disease which has destroyed so many plum trees in Canada.

Spot or Blight of the Native Plum (*Cladosporium carpophilum, V. Thumen*). —The almost complete absence of native plums during recent years in the Ottawa district and elsewhere in eastern Ontario and the province of Quebec, is due in a

large measure or almost entirely to the disease known as blight. The fruit forms and reaches more than half its size, but colours prematurely. When affected by the disease it shrivels and falls to the ground without ripening. If the fruit is examined when half grown or later, small pale green or yellow patches will be noticed. These gradually enlarge until finally they are about half an inch in diameter, at which time the blotches are darker in colour, of more irregular outline and are raised in the skin. The Americana plums are not, as a rule, seriously affected with this disease, which is principally confined to the Nigra varieties.

Remedy.—The fungus is nearly related to the apple spot and can be satisfactorily treated in much the same way. The trees should be sprayed with Bordeaux mixture just after the blossoms fall, again two weeks later, and a third two weeks after the second application. It is also advisable to spray a fourth time with ammoniacal copper carbonate just when the fruit is beginning to colour. The native varieties ripen early, and if the ordinary Bordeaux mixture were applied the last time, the fruit might remain stained. The ammoniacal copper carbonate does not leave a noticeable stain on the fruit. This remedy has been very satisfactorily used by one grower in particular near Ottawa who has thus been able to grow native plums very profitably. The Americana varieties may be top grafted on the native ones with the result that there will be less disease, as the latter are not as much affected as the native. All other plum trees not looked after or bearing poor fruit should be burned; also all fruit which is diseased.

Shot-Hole or Leaf-Spot (*Cylindrosporium padi*).—The first indications of this disease are small, yellowish spots with reddish margins, which appear on the young leaves. These spots increase in size and finally reach a diameter averaging about one-eighth to one-sixth of an inch. When fully grown, the central part dries up and drops out, leaving a clean cut around the margin, very suggestive of a shot-hole, after which the disease is named. When these spots occur in large numbers, as they frequently do so much of the leaf is destroyed that it drops prematurely. The early dropping of the leaves prevents the fruit, twigs and buds reaching their full development, and on this account causes serious injury where the disease is troublesome. To control this disease Bordeaux mixture is recommended, the first spraying to be made about ten days after the blossoms fall; the second, three weeks later, and the third, three or four weeks after the second. At the Central Experimental Farm, Americana and Nigra plums have been thoroughly sprayed with Bordeaux mixture from three to five times, without satisfactory results. Some varieties are more susceptible to the disease than others.

Plum Pockets (*Exoascus Pruni*).—The disease of plum known as 'plum pockets' does not cause widespread injury, but in some places does occasion considerable loss. The mycelium of the fungus which causes the pockets lives year after year in the same tree, and thus it is not necessary for a tree to be infected by the spores every year in order to perpetuate the disease. The fruit is affected soon after the trees have blossomed and is indicated by the unnatural swelling and bladder-like appearance of the fruit and by its unusual yellow colour. When the spores of the disease which has been working inside the fruit appear on the surface they give the pockets a gray appearance. Later on, the pockets turn almost black and fall to the ground. The leaves and twigs are also noticeably affected with this disease, the former becoming curled and unhealthy looking and the twigs swelling unnaturally. There is no known effective remedy for this disease, but it will probably be much lessened if the affected parts with the pockets are cut off and burned. At the Central Experimental Farm there is no trouble with this disease where the trees are sprayed with Bordeaux mixture, and we would suggest as the most effective spray, that before the flower buds open the trees be sprayed with Bordeaux mixture or lime-sulphur wash.

Gummosis.—The exudation of gum from plum trees, which is known as gumming or gummosis, is quite common in plum orchards. It has been given careful study and

is not attributed to any one disease. The conclusion reached is that any weakening of the tree by severe pruning, by winter, by injury to the trunk or branches, or by diseases or insects of different kinds will cause gumming. It is often very noticeable when trees are affected with the Ripe Rot fungus. It appears to follow any breaking or injury to the wood tissue.

MICE.—Mice often girdle the trees in the orchard in winter, especially when it is in sod or when there is rubbish lying about in which they like to harbour. Everything in the way of rubbish should, however, be removed before winter. Their depredations may be prevented either by wrapping the trunks with building paper in autumn and banking up the earth about the base to the height of about a foot; by encircling the trunk with fine galvanized iron netting; or by using the veneer protectors used to prevent scalding. Where the latter are used the earth should be banked up a little at the base to prevent the mice from going underneath.

If a tree is girdled by mice it usually dies. If, however, as soon as the injury is noticed, the wound is cleaned and covered with grafting wax and wrapped with cloth so that the air is excluded and the wood prevented from drying out, the sap which rises through the soft wood will continue to do so and returning through the inner bark, growth will be made all around the upper part of the wound, and if the latter be not too large there is a chance of its healing over. If, however, the wood becomes dry before the bandage is put on it will almost certainly die. When the wax and bandage are applied the tree should be headed back considerably to lessen the amount of transpiration of moisture, as there will not be as much sap rise as if the tree were uninjured. Girdled trees are sometimes saved by connecting the upper and lower edges of the girdle with scions, which are inserted all around the trunk. Mice may be destroyed in the orchard by using a mixture of one part by weight of arsenic with three parts of corn meal. To use this safely nail two pieces of board each six feet long and six inches wide together so as to make a trough. Invert this near the trees to be protected and place about a tablespoonful of the poison on a shingle and put it near the middle of the run, renewing the poison as often as is necessary.

INSECTS MOST INJURIOUS TO THE PLUM.

The insects which affect the plum and other fruits may be divided into two classes according to the nature of their mouth parts. Those of the first or larger division, Biting Insects, are furnished with mandibles, or biting jaws, by means of which they consume the substance of their food, as caterpillars, beetles, &c. The second class, Sucking Insects, have, instead of mandibles, a beak or tube, by means of which they suck up their food in a liquid form from beneath the surface, as the true bugs, plant-lice, &c. As regards the insects of the first class, all that it is necessary to do is to place on the food plant some poisonous material which will be eaten with the food. With the second class, however, this would be useless, for they would push their beaks through the poisonous covering on the outside of the food plant and extract from the interior the juices upon which they live. For this class, therefore, some substance must be used which will kill by mere contact with their bodies.

INSECTICIDES AND FUNGICIDES.

The following are the formulæ of remedies recommended:—

I.—ARSENATE OF LEAD.

For Biting Insects.

Arsenate of Lead	3 lbs.
Water	40 gallons.

II.—Paris Green.

For Biting Insects.

Paris green	1 lb.
Lime (fresh)	1 lb.
Water	160 gallons.

For dry application.—1 lb. Paris green with 50 lbs. flour, land plaster, slaked lime or any other perfectly dry powder.

III.—Kerosene Emulsion.

(RILEY-HUBBARD FORMULA.)

For Scale Insects and Plant-lice.

Kerosene (coal oil)	2 gallons.
Rain water	1 gallon.
Soap	½ lb.

Dissolve soap in water by boiling; take from fire, and, while hot, turn in kerosene and churn briskly for five minutes. To be diluted before use with nine parts of water.

IV.—Whale-oil Soap.

For scale-insects (young)	1 lb. in 5 gallons water.
For aphis	1 lb. in 6 gallons water.

V.—Tobacco and Soap Wash.

For Plant-lice or Aphis.

Soak in hot water for a few hours 10 lbs. of tobacco leaves (home grown will do); strain off, and add 2 lbs. of whale-oil soap. Stir until all is dissolved, and dilute to 40 gallons. Apply early and two or three times at short intervals.

VI.—Black Leaf 40.

For aphis .. .. 1 ounce in 6¼ gallons water.

VII.—Poisoned Bordeaux Mixture.

For Fungi and Insects on Plum-trees.

Copper sulphate (bluestone)	3 lbs.
Lime (fresh)	4 lbs.
Arsenate of Lead (or Paris Green 4 ounces)	3 lbs.
Water (1 barrel)	40 gallons.

Dissolve the copper sulphate (by suspending it inside a wooden or earthen vessel containing 4 or 5 or more gallons of water). Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place; half fill the barrel with water, add the slaked lime, fill the barrel with water and stir thoroughly. Add the poison and it is then ready for use.

Stock solutions of dissolved copper sulphate and of lime may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of bluestone, lime and water should be carefully noted.

VIII.—Copper Sulphate Solution.

For Fungi.

Copper sulphate (bluestone)	1 lb.
Water	25 gallons.

As soon as dissolved it is ready for use. ***For use only before the buds open.***

IX.—Ammoniacal Copper Carbonate.

For Fungi.

Copper carbonate	5 oz.
Ammonia	2 quarts.
Water (1 barrel)	40 gallons.

Dissolve the copper carbonate in the ammonia. The ammonia and concentrated solution should be kept in glass or stone jars tightly corked. It is ready for use as soon as diluted with the 40 gallons water. To be used when Bordeaux cannot be applied on account of staining the fruit.

X.—Lime-Sulphur Wash.

For San José Scale and Fungous Diseases.

Lime	20 lbs.
Sulphur, powdered	15 lbs.
Water to make	40 gallons.

Slake the lime with only enough water to do it thoroughly. Add the sulphur by dusting it over the lime while slaking; stir well and boil for at least an hour, adding only so much hot water as is necessary for easy stirring. When thoroughly cooked, strain through sacking, and apply hot. For use when there is no foliage.

When concentrated lime-sulphur wash is used it should be diluted for use, when there are no leaves on the trees, to 1 gallon of the concentrated wash to about 9 gallons of water varying with the density of the wash. For use when there is foliage the lime-sulphur should be diluted to 1 gallon of the concentrated wash to 35 to 40 gallons of water. A hydrometer may be used to determine the density of the wash. Arsenate of lead is the best poison to use with the lime-sulphur wash. Arsenite of lime will injure foliage.

THE WORST ENEMIES OF THE PLUM TREE.

ATTACKING THE FOLIAGE.

1. The Eye-spotted Bud-moth *(Tmetocera ocellana).*—Small, dark brown caterpillars, ¼ of an inch in length, with black heads and collars, destroying the buds when just unfolding and later attacking the leaves, two or three of which they attach together, feeding inside. They also sometimes bore down the centre of the twig. *Remedy:*—Spray early with arsenate of lead, 3 lbs. to 40 gallons, or a strong Paris green wash (Paris green 1 pound, fresh lime 1 pound, water 100 gallons).

2. The Cigar Case-bearer *(Coleophora fletcherella).*—Small orange-coloured caterpillars with black heads, encased in brown leathery cigar-shaped cases, which they carry about with them. They pass the winter as caterpillars on the twigs, and cluster around the opening buds, injuring the foliage and flowers. *Remedy:*—Spray early with the wash mentioned under No. 1 above, or with kerosene emulsion (Formula III.).

3. TENT CATERPILLARS (*Malacosoma*).—Two kinds attack the foliage of the plum as well as many other trees. The Apple Tent Caterpillar forms a tent in the fork of two twigs; the Forest Tent Caterpillar does not make a tent but spins a flat mat of silk on the side of a branch or on the trunk; to these resting places the young caterpillars resort when not feeding. The mature insects are thick-bodied, reddish-brown moths expanding from 1 to about 1½ inches across the wings, which are crossed obliquely by two bands. These bands are pale in the first named, but dark in the moth of the Forest Tent Caterpillar. During July the females lay rings of about 200 eggs on the twigs of the trees, in which state the insect passes the winter. *Remedies:*—Collect and destroy the egg clusters during the winter. Spray the trees with poison (Formula I. or VII.), directly the young caterpillars are noticed. All tents should also be cut off and destroyed early before the leaves hide them.

4. PLANT-LICE OR APHIDES (*Aphis prunifoliæ*).—In appearance and habits much the same as the Apple Aphis, clustering on the underside of leaves, sucking out the juices and causing the leaves to become wrinkled and twisted. *Remedies:*—Whale-oil soap 1 lb. in 6 gallons of water (Formula IV.), or tobacco and soap wash (Formula V.), or kerosene emulsion (Formula III.), or Black Leaf 40 (Formula VI.). Begin to spray when the plant-lice are first noticed. Once the leaves have curled it will be almost impossible to reach them all.

5. THE PEAR-TREE SLUG OR CHERRY-TREE SLUG (*Eriocampoides limacina*).—In June and August, slimy, greenish-brown, slug-like caterpillars, ½ inch long, feeding on the upper surface of the leaves, often doing considerable damage to plum trees. *Remedies:*—Spray with arsenate of lead, a weak solution of Paris green, or dust with freshly slaked lime, or Paris green diluted with 50 times its weight of some dry powder.

6. PLUM LEAF CATERPILLARS.—There are other kinds of leaf-eating caterpillars which occasionally occur in sufficient numbers on the foliage of plum trees to do serious injury. *Remedy:*—Spraying regularly with Formula VII. will prevent injury from these insects.

ATTACKING THE WOOD.

7. The SHOT-BORER (*Xyleborus dispar*).—Small blackish beetles, which bore into the trunks and limbs, causing serious damage in apple and plum orchards. *Remedy:*—Wash the trees liable to attack three times, early and late in June and once in July, with the following:—Soft soap, 1 gallon; water, 3 gallons; carbolic acid, ½ pint.

OCCURRING ON THE BARK.

8. The SAN JOSÉ SCALE (*Aspidiotus perniciosus*).—Minute, almost circular scale-insects, one-thirtieth of an inch wide, shaped like an inverted saucer, with a depressed ring around a central point; inside this ring, black or dark coloured. This very inconspicuous insect when in small numbers is easily overlooked, but when abundant gives to the bark a dirty, scurfy and grayish colour, as though dusted with ashes. *Remedy:*—Lime-sulphur wash sprayed on the trees when there are no leaves in the proportion of about 1 gallon concentrated lime sulphur to 9 gallons of water, has proved the best remedy.

9. The NEW YORK PLUM SCALE (*Eulecanium cerasifex*).—Conspicuous, dark brown, hemispherical scales, about ⅙ of an inch long by ⅓ of an inch wide, occurring at all times of the year, clustered along the small branches, particularly along the lower sides. The presence of this enemy upon a plum tree may be detected especially in July and August and also in the spring, by the filthy black condition of the bark due to the growth of a fungus upon the copious deposit of honey-dew which is emitted by

the young scale insects during the time of their growth. *Remedies:*—Spray the trees during the winter with kerosene emulsion (Formula III.) diluted with four parts of water, or with the whale-oil soap solution (Formula IV.).

ATTACKING THE FRUIT.

10. The PLUM CURCULIO *(Conotrachelus nenuphar).*—Small, rough, grayish beetles about ⅛ of an inch long. The females, in the operation of egg-laying, make upon the sides of plums small crescent-shaped marks, with a single hole in the centre of each. An egg is laid in the central spot, from which hatches a white grub; this soon destroys the fruit. *Remedies:*—(1) The mature beetles feed in early spring upon the unopened buds and afterwards upon the young leaves, and may be reached by spraying the trees before the buds open with arsenate of lead (Formula I.) or Paris green (Formula II.), repeating this as soon as the fruit has formed, and spraying ten days later with the poisoned Bordeaux mixture (Formula VII.). (2) The beetles are sluggish in the early morning and drop from the trees if a sudden jar be given to the trunk. This jarring, if repeated every day or two over a sheet or other receptacle, will be the means of greatly lessening the numbers of the mature insects. The beetles drop readily and lie quietly for some time, when they can be easily collected and destroyed.

NOTE.

The operation of 'spraying' consists of applying liquids by means of a force pump and spraying nozzle, with such force as to break up the liquid so thoroughly that it falls upon the plants treated as an actual mist or spray. The word 'spraying,' however, to many who endeavour to practise this operation, has still little more meaning than doing something in any sort of a way, to fruit trees with a spraying pump. Such terms as 'sprinkling' and 'showering' are inaccurate for the operation here intended. Unfortunately, much of the so-called spraying as usually carried out, could more accurately be designated as sprinkling or showering, which describe a much less careful and less even distribution of liquids.

The above information on insects was prepared for the first edition of this bulletin by the late Dr. James Fletcher. Changes in the formulæ recommended have been made where necessary.

S
133
.E22

DEPARTMENT OF AGRICULTURE

Canada.

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

RESULTS OBTAINED IN 1903

FROM

TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS

AND

POTATOES

BY

WILLIAM SAUNDERS, LL.D.,
Director of Experimental Farms

AND

CHAS. E. SAUNDERS, Ph.D.
Experimentalist

BULLETIN No. 44

DECEMBER, 1903

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER,
MINISTER OF AGRICULTURE

TABLE OF CONTENTS

	Page.
Results of test plots for 1903	7
Varieties of oats	8
" barley	12
" spring wheat	15
" pease	20
" Indian corn	23
" turnips	25
" mangels	28
" carrots	31
" sugar beets	34
" potatoes	37
Average crops for a series of years	41
Varieties of oats	41
" barley	43
" spring wheat	46
" pease	48
" Indian corn	50
" turnips	52
" mangels	54
" carrots	56
" sugar beets	58
" potatoes	60
Conclusions	62

To the Honourable
The Minister of Agriculture.

SIR,—I herewith submit for your approval Bulletin No. 44 of the Experimental Farm series, which has been prepared by the Experimentalist, Dr. C. E. Saunders and myself. There are presented in this publication the results of a large number of experiments, which have been conducted at all the experimental farms in your Department during the season of 1903, with oats, barley, spring wheat, pease, Indian corn, turnips, mangels, carrots, sugar beets and potatoes, in plots of uniform size, and with the crops grown under uniform conditions. The average results are also given of the tests for a series of years of those varieties which have proved most productive.

These trial plots are conducted with the object of gaining information as to the relative productiveness of the different sorts and their earliness in ripening. The returns show much variation in the weight of the crops grown and point to the importance of care in the choice of varieties of seed for sowing. It is hoped that these results giving the experience gained under some of the most important climatic variations found in the country, will prove useful to farmers in every part of Canada.

I have the honour to be,
Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, December 10, 1903.

RESULTS OBTAINED IN 1903

FROM TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS AND POTATOES

By William Saunders, LL.D., F.R.S.C., F.L.S., F.C.S., &c.
Director of Experimental Farms,

And Chas. E. Saunders, B.A., Ph.D., Experimentalist.

During the past nine years experiments have been conducted on uniform trial plots at each of the Dominion Experimental Farms for the purpose of gaining information as to the most productive and earliest ripening varieties of grain, fodder corn, field roots and potatoes. In arranging for these plots the same varieties have been sown at each of the farms, the seed being supplied at the outset from a common stock. In each case seed has been sown early, and, as a rule, all the different sorts of the same crop have been sown on the same day or at most within two or three days so as to give to all an even start. The land chosen each year for these plots has been as nearly uniform in character as could be found and before sowing has been brought into a good condition of tilth. In this bulletin which is the ninth of the series, the details are arranged after the same plan as in the previous issues, except that the different varieties are placed in the tables in the order of their average productiveness at all the farms, instead of being arranged in the order of their yield at the Central Experimental Farm. The number of days required for all the sorts from sowing to ripening is also given and thus their relative earliness is shown.

In comparing the crops obtained from the several varieties in any one year with another, the relative positions occupied by the different sorts will often vary from lack of uniformity in the soil, and other causes. When, however, the average of such results can be given for a number of years the information becomes much more satisfactory and valuable. In the experience recorded near the end of this bulletin the

average crops obtained from the sowings of a number of successive years are shown, all those varieties which have been four years under trial being placed in competition with those which have been tested for longer periods.

The weather in the eastern parts of Canada was quite unusual during the past season. There was an almost unbroken drought from early in April until about the middle of June, which was followed by a long period of very wet weather. All the varieties of grain were more or less injured, but the early varieties of wheat suffered most. They were much dwarfed in growth and were heading out when the rains came, and although rapid growth followed, they did not recover to the same extent as the later ripening sorts. While all the varieties suffered a reduction in crop, the yields of the earliest varieties of wheat are in some cases remarkably low. The wet weather proved very favourable for the spread of rust, which further reduced the crop of grain. In the case of the field roots, the principal effect of the drought was to delay the germination of a large proportion of the seed of both sowings until about the middle of June, when the dormant seed of both first and second sowings germinated together.

OATS.

During the season of 1903, forty-five varieties of oats have been under trial. The size of the plots on which they were grown was one-fortieth of an acre at Ottawa, Ont., Nappan, N.S., and Agassiz, B.C.; while at Brandon, Man., and Indian Head, N.W.T., the plots were usually one-twentieth of an acre. The seed was sown at the rate of two bushels per acre ; and the dates of sowing were as follows :—At Ottawa, April 20 ; Nappan, May 4 ; Brandon, May 5 and 6 ; Indian Head, April 25 ; and at Agassiz, April 17.

Particulars as to the character of the land in each case, and of the preparation and treatment it has had will be found in the annual report of the Experimental Farms for 1903.

At Brandon the plot of Banner oats being on the outside of the block near the road, was somewhat injured by traffic. The Tartar King seed was very plump and heavy, and the plants did not tiller to any great extent : for these reasons the plot was too thin for the best results.

In Canada the bushel of oats is 34 lbs.

UNIFORM TEST PLOTS OF OATS FOR 1903.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms.												Number of Days from Sowing to Harvesting.					
		Average of all Farms.		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	Abundance	94	15	71	6	92	32	109	14	122	27	75	30	116	115	113	107	123	122
2	White Giant	93	17	74	4	94	4	103	28	121	21	73	28	118	116	119	109	122	122
3	Wide Awake	93	..	66	16	88	8	113	18	134	4	62	22	117	118	114	110	122	120
4	Sensation	92	8	67	22	98	28	91	6	121	16	82	..	115	117	114	108	122	116
5	Danish Island	91	14	60	20	90	20	108	8	115	..	82	22	117	115	115	109	122	124
6	Lincoln	90	15	62	12	89	14	108	28	129	29	61	26	118	115	113	109	122	122
7	Banner	90	10	71	6	95	10	84	4	136	26	64	4	115	115	113	107	124	118
8	Golden Tartarian	90	2	71	26	77	22	106	6	122	32	71	26	120	120	121	112	126	122
9	Waverley	89	30	61	6	97	22	109	14	108	28	72	12	116	116	119	107	123	116
10	Thousand Dollar	88	27	55	10	97	22	105	10	132	27	52	32	116	117	114	107	122	119
11	Improved Ligowo	88	22	67	22	89	14	105	20	111	26	68	28	115	115	114	107	122	116
12	Twentieth Century	87	30	71	6	97	22	104	14	110	20	55	20	116	119	112	109	122	117
13	Bavarian	87	28	56	16	81	6	91	26	126	26	82	32	116	115	114	109	125	118
14	Swedish Select	87	16	70	20	87	2	94	4	126	16	59	4	116	119	115	106	126	116
15	Golden Giant	87	4	86	16	60	.	109	14	118	18	61	6	120	116	119	116	126	123
16	*Kendal White	86	30	67	2	75	10	91	26	127	2	73	8	117	116	114	109	126	118
17	Holstein Prolific	86	28	55	10	82	12	107	32	127	32	60	20	116	116	113	109	123	120
18	Mennonite	86	14	70	.	82	12	98	28	119	24	61	6	115	117	113	105	123	117
19	Early Golden Prolific	85	32	47	22	84	24	115	10	120	..	63	2	117	116	116	109	126	116
20	Black Beauty	85	22	67	2	84	24	93	8	122	12	60	30	114	115	108	106	123	116
21	Columbus	85	20	70	20	62	12	104	14	111	26	78	28	116	115	115	108	126	117
22	Improved American	85	6	61	26	84	24	95	10	125	10	58	28	115	115	114	107	122	118
23	Siberian	84	29	70	20	96	16	98	28	89	9	69	4	119	118	114	110	133	118
24	*Olive Black	84	22	61	6	88	8	88	8	121	26	63	28	118	117	116	112	128	119
25	Golden Fleece	84	22	64	24	82	12	84	4	120	30	71	6	116	117	115	108	128	119
26	Irish Victor	84	21	60	20	58	28	107	22	123	33	72	2	116	117	114	109	123	119
27	Buckbee's Illinois	84	15	54	24	62	12	119	14	126	31	58	28	118	119	117	108	123	124
28	Salines	84	3	62	32	85	30	95	10	116	1	60	10	120	119	121	111	124	124
29	Golden Beauty	84	2	73	18	64	24	93	18	127	2	61	16	115	114	114	109	122	118
30	Goldfinder	83	22	59	14	92	32	83	18	117	22	64	24	119	118	119	111	128	120
31	American Triumph	83	2	65	30	58	28	98	18	123	18	68	18	118	120	117	109	125	118
32	*Milford White	82	20	59	14	74	4	77	22	119	14	82	12	117	116	114	112	126	117
33	White Schonen	81	18	48	8	88	8	100	20	108	8	62	12	114	114	114	109	116	118
34	New Zealand	81	16	50	..	70	20	114	24	112	22	59	14	123	120	120	115	133	126
35	Joanette (Black)	80	14	55	10	94	4	83	18	105	30	63	8	115	118	110	107	127	115
36	American Beauty	80	8	55	30	71	26	99	14	115	20	58	18	116	117	113	109	123	120
37	*Olive White	79	10	60	20	71	26	80	20	109	14	74	4	117	116	116	112	126	117
38	*Kendal Black	79	6	57	22	75	10	82	12	117	2	63	18	118	117	114	112	126	120
39	Scotch Potato	79	3	77	2	68	8	91	26	100	15	57	32	117	116	115	109	123	120
40	*Pense White	79	2	64	4	69	14	80	..	115	10	66	16	117	114	116	112	126	118
41	Pioneer (Black)	78	11	48	8	85	30	88	18	104	19	64	14	114	118	108	106	123	115
42	*Milford Black	77	24	51	6	80	..	87	12	114	24	55	10	118	117	114	112	126	119
43	Tartar King	77	3	61	26	70	20	77	22	97	22	77	28	113	112	109	107	122	115
44	*Pense Black	76	28	41	6	81	6	85	10	115	..	61	16	119	117	116	112	128	124
45	Wallis	76	6	44	4	83	18	99	4	97	22	56	16	117	115	114	110	125	122

* Cross-bred varieties produced at the Experimental Farms.

The twelve varieties of oats which have produced the largest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Abundance	94	15	7. Banner	90	10
2. White Giant	93	17	8. Golden Tartarian	90	2
3. Wide Awake	93	..	9. Waverley	89	30
4. Sensation	92	8	10. Thousand Dollar	88	27
5. Danish Island	91	14	11. Improved Ligowo	88	22
6. Lincoln	90	15	12. Twentieth Century	87	30

An average crop of 90 bushels 30 lbs. per acre.

The twelve varieties of oats which have produced the largest crops during 1903, at the several experimental farms, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Golden Giant	86	16	7. Abundance	71	6
2. Scotch Potato	77	2	8. Twentieth Century	71	6
3. White Giant	74	4	9. Siberian	70	20
4. Golden Beauty	73	18	10. Columbus	70	20
5. Golden Tartarian	71	26	11. Swedish Select	70	20
6. Banner	71	6	12. Mennonite	70	..

An average crop of 73 bushels 6 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Sensation	98	28	7. Joanette	94	4
2. Twentieth Century	97	22	8. White Giant	94	4
3. Thousand Dollar	97	22	9. Abundance	92	32
4. Waverley	97	22	10. Goldfinder	92	32
5. Siberian	96	16	11. Danish Island	90	20
6. Banner	95	10	12. Improved Ligowo	89	14

An average crop of 94 bushels 27 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Buckbee's Illinois	119	14	7. Waverley	109	14
2. Early Golden Prolific	115	10	8. Lincoln	108	28
3. New Zealand	114	24	9. Danish Island	108	8
4. Wide Awake	113	18	10. Holstein Prolific	107	32
5. Golden Giant	109	14	11. Irish Victor	107	22
6. Abundance	109	14	12. Golden Tartarian	106	6

An average crop of 110 bushels 28 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Banner	136	26	7. Golden Beauty	127	2
2. Wide Awake	134	4	8. Buckbee's Illinois	126	31
3. Thousand Dollar	132	27	9. Bavarian	126	26
4 Lincoln	129	29	10. Swedish Select	126	16
5. Holstein Prolific	127	32	11. Improved American	125	10
6. Kendal White	127	2	12. Irish Victor	123	33

An average crop of 128 bushels 26 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Bavarian	83	8	7. Abundance	75	30
2. Danish Island	82	22	8. Olive White	74	4
3 Milford White	82	12	9. White Giant	73	28
4. Sensation	82	..	10. Kendal White	73	8
5. Columbus	78	28	11. Waverley	72	12
6. Tartar King	78	28	12. Irish Victor	72	2

An average crop of 77 bushels 12 lbs. per acre.

The average crop of all the varieties of oats tested at each of the experimental farms in 1903 was as follows :—At Ottawa, 62 bushels 9 lbs. per acre ; Nappan, 81 bushels 18 lbs. ; Brandon, 97 bushels 4 lbs. ; Indian Head, 117 bushels 23 lbs. ; and at Agassiz, 66 bushels 4 lbs. The average return given by the whole of the varieties of oats tested at all the farms was 84 bushels 18 lbs. per acre.

BARLEY.

During the season of 1903, fifteen varieties of two-rowed barley and twenty varieties of six-rowed barley have been under test. The barley plots were of the same size as those sown with oats. The seed was used in the proportion of two bushels per acre ; and the dates of sowing were as follows :—At Ottawa, Ont., April 17 and 18 ; Nappan, N.S., May 13 ; Brandon, Man., May 7 and 8, and June 5 ; Indian Head, N.W.T., April 29, and at Agassiz, B.C., April 25.

All the plots of two-rowed barley at Brandon were frozen on September 4, so that the number of days for maturing can only be given approximately. The sowing of these plots so late (June 5) accounts for the unsatisfactory results. The plots were first sown in good season (May 8), but were washed out by a heavy rain storm, making a second sowing necessary.

In Canada the bushel of barley is 48 lbs.

UNIFORM TEST PLOTS OF TWO-ROWED BARLEY FOR 1903.

Number.	Name of Variety	Yield per Acre at the Several Experimental Farms.												Number of Days from Sowing to Harvesting.					
		Average of all Farms.		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	Invincible	55	34	46	32	55	40	32	24	77	14	66	12	108	105	103	101	115	115
2	French Chevalier	54	28	44	28	58	16	27	34	71	22	70	40	109	105	101	105	117	117
3	Canadian Thorpe	54	10	46	32	59	8	24	28	71	2	69	28	106	107	101	102	108	114
4	Standwell	53	22	35	..	52	24	31	42	80	40	67	4	110	109	103	106	115	115
5	*Beaver	53	16	42	24	60	40	32	4	56	12	75	..	107	104	100	104	112	117
6	Danish Chevalier	52	24	37	4	65	..	28	46	66	2	65	20	109	107	101	105	117	115
7	*Sidney	51	26	39	8	43	16	39	18	62	24	73	16	107	107	101	100	108	117
8	*Dunham	51	16	37	44	49	8	40	30	52	14	76	32	107	108	101	102	109	114
9	*Gordon	51	14	41	32	46	32	30	..	64	28	73	26	105	106	101	105	107	108
10	Newton	50	26	31	12	64	8	33	16	61	2	62	44	107	108	101	104	115	109
11	*Logan	48	40	37	4	45	40	37	34	62	14	61	12	106	109	101	101	105	112
12	*Harvey	48	..	40	..	40	40	35	..	58	16	65	40	105	109	101	100	103	110
13	*Fulton	47	10	37	4	48	16	33	36	58	46	57	44	106	108	103	101	103	116
14	*Jarvis	47	..	46	12	40	..	30	30	61	22	56	32	105	106	101	100	108	109
15	*Clifford	45	28	36	32	42	24	31	42	57	14	59	28	106	109	100	105	105	109

* Cross-bred varieties produced at the Experimental Farms.

The six varieties of two-rowed barley which have produced the largest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1 Invincible	55	34	4. Standwell	53	22
2. French Chevalier	54	28	5. Beaver	53	16
3. Canadian Thorpe	54	10	6. Danish Chevalier	52	24

An average crop of 53 bushels 46 lbs. per acre.

The six varieties of two-rowed barley which have given the largest crops during 1903, at the several experimental farms, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Canadian Thorpe	46	32	4. French Chevalier	44	28
2. Invincible	46	32	5. Beaver	42	24
3. Jarvis	46	12	6. Gordon	41	32

An average crop of 44 bushels 35 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Danish Chevalier	65	..	4. Canadian Thorpe	59	8
2. Newton	64	8	5. French Chevalier	58	16
3. Beaver	60	40	6. Invincible	55	40

An average crop of 60 bushels 27 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Dunham	40	30	4. Harvey	35	..
2. Sidney	39	18	5. Fulton	33	36
3. Logan	37	34	6. Newton	33	16

An average crop of 36 bushels 30 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Standwell	80	40	4. Canadian Thorpe	71	2
2. Invincible	77	14	5. Danish Chevalier	66	2
3. French Chevalier	71	22	6. Gordon	64	28

An average crop of 71 bushels 42 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Dunham	76	32	4. Sidney	73	16
2. Beaver	75	..	5. French Chevalier	70	40
3. Gordon	73	26	6. Canadian Thorpe	69	28

An average crop of 73 bushels 8 lbs. per acre.

The average crop of all the varieties of two-rowed barley tested at each of the experimental farms in 1903 was as follows :—At Ottawa, 39 bushels 47 lbs. per acre ; Nappan, 51 bushels 24 lbs. ; Brandon, 32 bushels 32 lbs ; Indian Head, 64 bushels 5 lbs., and at Agassiz, 66 bushels 38 lbs. The average return given by the whole of the varieties of two-rowed barley tested at all the farms was 50 bushels 47 lbs. per acre.

UNIFORM TEST PLOTS OF SIX-ROWED BARLEY FOR 1903.

Number.	Name of Variety	Yield per Acre at the Several Experimental Farms.												Number of Days from Sowing to Harvesting.					
		Average of all Farms.		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	Mensury	62	40	38	36	60	..	71	32	63	36	80	..	103	10[illegible]	101	95	108	105
2	* Brome	61	38	53	36	53	16	66	32	63	26	71	32	103	10[illegible]	103	95	113	103
3	Odessa	60	12	44	28	60	40	66	12	71	12	58	16	97	10[illegible]	97	84	106	100
4	*Trooper	60	..	52	4	65	..	53	16	64	8	65	20	102	99	99	95	110	109
5	Oderbruch	59	38	42	44	66	32	63	16	54	38	71	12	100	100	98	92	107	103
6	*Nugent	59	32	42	4	64	8	72	4	54	28	65	20	105	107	104	94	112	109
7	*Empire	59	32	45	20	65	40	61	32	56	32	68	36	104	100	100	96	113	109
8	*Summit	59	24	54	28	54	8	67	14	61	2	60	20	104	98	104	98	113	109
9	Common	59	20	44	28	63	16	61	32	60	20	67	4	99	98	99	91	106	101
10	*Mansfield	58	30	34	28	55	40	66	12	63	6	73	16	103	100	101	96	108	109
11	*Stella	58	1	51	12	58	16	53	46	54	3	72	24	104	98	104	94	112	114
12	*Albert	56	2	47	4	59	8	58	36	53	26	61	32	103	106	99	95	108	109
13	*Royal	55	40	41	12	58	16	50	40	60	..	68	36	102	106	99	95	110	100
14	*Yale	55	22	45	..	53	16	70	..	53	46	55	..	104	100	104	94	112	109
15	*Garfield	53	30	52	4	50	..	55	20	55	30	55	..	102	98	100	94	111	109
16	*Claude	53	24	35	40	48	16	55	20	65	40	62	4	103	107	99	94	112	105
17	*Argyle	53	20	34	28	54	8	55	40	56	32	65	40	103	100	100	95	111	108
18	Rennie's Improved	53	4	42	44	45	40	53	46	57	14	65	20	99	98	99	92	106	102
19	Baxter	52	8	45	20	59	8	41	12	50	20	64	28	100	97	99	95	108	103
20	Champion	45	40	40	20	49	8	32	24	45	20	61	32	96	96	96	88	103	99

* Cross-bred varieties produced at the Experimental Farms.

The six varieties of six-rowed barley which have produced the largest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury	62	40	4. Trooper	60	..
2. Brome	61	38	5. Oderbruch	59	38
3. Odessa	60	12	6. Nugent	59	32

An average crop of 60 bushels 35 lbs. per acre.

The six varieties of six-rowed barley which have given the largest crops during 1903, at the several experimental farms, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Summit	54	28	4. Garfield	52	4
2. Brome	53	36	5. Stella	51	12
3. Trooper	52	4	6. Albert	47	4

An average crop of 51 bushels 39 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Oderbruch	66	32	4. Nugent	64	8
2. Empire	65	40	5. Common	63	16
3. Trooper	65	..	6. Odessa	60	40

An average crop of 64 bushels 15 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Nugent	72	4	4. Summit	67	14
2. Mensury	71	32	5. Brome	66	32
3. Yale	70	..	6. Mansfield	66	12

An average crop of 69 bushels per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Odessa	71	12	4. Mensury	63	36
2. Claude	65	40	5. Brome	63	26
3. Trooper	64	8	6. Mansfield	63	6

An average crop of 65 bushels 13 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury	80	..	4. Brome	71	32
2. Mansfield	73	16	5. Oderbruch	71	12
3. Stella	72	24	6. Empire	68	36

An average crop of 72 bushels 44 lbs. per acre.

The average crop of all the varieties of six-rowed barley tested at each of the experimental farms in 1903 was as follows :—At Ottawa, 44 bushels 22 lbs. per acre ; Nappan, 57 bushels 12 lbs.; Brandon, 58 bushels 44 lbs.; Indian Head, 58 bushels 15 lbs. ; and at Agassiz, 63 bushels 34 lbs. The average return given by the whole of the varieties of six-rowed barley tested at all the farms was 56 bushels 45 lbs. per acre.

SPRING WHEAT.

Fifty-eight varieties of spring wheat have been grown on the uniform test plots during the past season. The plots were of the same size as those sown with oats, and the seed was used at the rate of one and one-half bushels per acre. The dates of sowing were as follows :—At Ottawa, Ont., April 14 ; Nappan, N.S., April 29 ; Brandon, Man., April 21 to 24 ; Indian Head, N.W.T., April 18, and at Agassiz, B.C., April 18.

In Canada the bushel of wheat is 60 lbs.

UNIFORM TEST PLOTS OF SPRING WHEAT FOR 1903.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms.												Number of Days from Sowing to Harvesting.					
		Average of all Farms.		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.		Average of all Farms.	Ottawa, Ont.	Nappan, N.S.	Brandon, Man.	Indian Head, N.W.T.	Agassiz, B.C.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	*Advance	35	14	34	40	32	40	28	10	38	..	42	40	122	115	118	121	142	114
2	Roumanian	34	36	27	..	21	20	44	40	41	..	39	50	125	115	122	124	143	119
3	Wellman's Fife	34	18	29	..	38	..	30	20	33	10	41	..	127	122	124	123	142	123
4	*Byron	34	10	26	20	42	40	27	40	35	20	38	50	119	108	119	123	133	114
5	Monarch	33	8	28	..	35	20	26	..	35	..	41	20	125	123	122	121	139	121
6	*Preston	32	58	29	40	28	..	23	40	43	10	40	20	122	113	121	123	136	119
7	White Connell	32	58	27	20	35	20	26	..	35	..	41	10	126	122	124	123	141	121
8	White Fife	32	39	27	..	36	..	27	40	36	5	36	30	126	123	124	123	141	118
9	Goose	32	32	19	..	22	..	46	20	36	10	39	10	123	115	120	126	141	114
10	*Chester	32	27	19	20	40	..	33	30	36	15	33	10	122	116	120	120	138	115
11	*Crawford	32	25	21	40	36	40	29	..	37	15	37	30	119	108	122	120	133	112
12	*Clyde	32	18	25	..	34	..	25	30	36	..	41	..	124	118	122	124	133	123
13	Red Fife	32	14	25	14	36	40	24	20	38	30	36	..	126	123	121	123	142	121
14	*Norval	32	9	25	40	34	40	27	..	38	45	34	40	121	118	120	122	133	112
15	*Laurel	32	..	21	..	36	..	26	..	36	20	40	40	127	121	124	123	†147	121
16	White Russian	31	58	26	40	30	40	30	40	31	50	40	..	127	121	122	124	†147	123
17	*Percy	31	44	19	40	26	40	29	10	36	30	46	40	122	115	122	122	136	114
18	Hungarian	31	40	27	20	24	40	28	20	42	..	36	..	122	113	121	122	137	116
19	Pringle's Champlain	31	38	26	..	30	..	24	50	41	40	35	40	123	117	121	119	139	119
20	*Huron	31	28	26	..	26	40	27	40	39	..	38	..	123	118	121	123	136	115
21	*Benton	31	24	30	20	20	40	29	20	36	30	40	10	124	113	122	122	138	123
22	*Alpha	31	22	20	20	30	..	28	..	37	40	40	50	123	118	120	123	136	118
23	*Essex	31	20	25	20	38	..	21	30	32	20	39	30	126	121	122	122	†147	120
24	*Stanley	31	12	22	40	28	40	27	40	39	10	37	50	121	109	121	120	136	118
25	Power's Fife (Minn. No. 149)	31	6	22	..	37	20	26	50	32	30	36	50	128	124	124	124	†147	122
26	*Crown	31	6	23	20	31	20	24	50	37	..	39	..	122	118	120	120	139	115
27	Herisson Bearded	31	4	25	40	31	20	23	20	35	20	34	40	126	114	120	124	†147	123
28	McKendry's Fife (Minn. No. 181)	30	57	30	20	32	..	25	..	30	25	37	..	129	124	124	124	†147	125
29	*Weldon	30	48	24	..	23	20	28	40	43	40	34	20	125	118	122	120	143	123
30	Robin's Rust Proof	30	28	28	20	28	40	25	30	30	50	39	..	123	118	124	122	136	116
31	*Admiral	30	24	19	..	36	..	27	40	32	30	36	50	123	116	122	122	136	119
32	*Bishop	30	19	21	40	31	20	28	40	28	15	41	40	120	108	120	122	136	115
33	Rio Grande	30	2	20	40	36	40	26	..	31	30	35	20	126	124	120	122	142	122
34	*Fraser	30	1	19	40	19	20	31	20	39	35	40	10	117	105	120	116	130	114
35	*Angus	30	..	21	40	26	..	30	..	38	50	33	30	122	115	122	120	136	116
36	*Dawn	29	48	20	20	34	..	30	20	33	40	30	40	120	112	120	119	132	115
37	*Blair	29	36	22	40	20	..	31	30	33	50	40	..	123	115	122	122	133	124
38	*Early Riga	29	14	10	..	42	..	22	20	35	10	36	40	116	105	115	119	129	112
39	Australian, No. 9	29	10	14	40	29	20	34	..	32	..	35	50	125	109	124	121	†147	122
40	Minnesota, No. 163	29	8	29	20	28	40	21	20	27	..	39	20	128	124	124	125	†147	122
41	Australian, No. 27	28	57	23	20	20	.	23	20	37	35	40	30	127	121	124	122	†147	121
42	Red Fern	28	48	21	40	22	..	25	50	34	10	40	20	125	118	121	122	142	121
43	*Countess	28	48	22	20	25	20	20	50	35	50	39	40	120	108	122	121	133	115
44	*Cartier	28	30	21	20	18	40	27	40	33	30	41	20	119	108	121	119	133	114
45	*Hastings	28	24	19	40	16	40	25	40	38	20	41	40	122	113	122	120	142	112
46	Australian, No. 19	28	21	24	20	17	20	22	20	33	45	44	.	127	123	124	125	†147	114
47	*Plumper	28	18	20	..	16	40	28	..	34	50	42	..	122	114	122	125	136	115
48	Australian, No. 23	28	11	24	20	33	20	21	50	26	55	34	30	128	122	124	124	†147	122
49	Red Swedish	27	42	18	20	35	20	18	10	29	20	37	20	125	121	122	120	†147	114
50	*Cassel	27	29	14	20	26	..	26	50	30	55	39	20	125	118	124	122	136	126
51	Colorado	27	25	22	..	24	..	19	20	35	25	36	20	123	114	118	122	138	124
52	*Progress	27	22	18	40	24	40	23	40	34	30	35	20	123	114	121	123	136	122
53	Japanese	27	20	19	..	30	40	26	40	27	40	32	40	117	106	122	116	130	112
54	*Vernon	26	48	18	40	30	..	27	..	25	30	32	50	122	118	121	122	136	115
55	Australian, No. 25	26	27	22	20	18	..	22	..	31	15	38	40	126	121	124	124	†147	116
56	Australian, No. 10	26	17	18	..	27	20	21	40	26	45	37	40	128	122	124	125	†147	122
57	Australian, No. 13	25	49	21	..	32	..	18	..	22	35	35	30	128	123	124	125	†147	122
58	Haynes' Blue Stem (Minn. No. 169)	24	57	24	20	26	..	18	30	21	35	34	20	129	125	124	125	†147	124

* Cross-bred varieties produced at the Experimental Farms.

† These varieties were not fully ripe, but had to be cut on Sept. 8, on account of frost. The number of days maturing is therefore only roughly estimated from the condition of the grain when cut.

The twelve varieties of spring wheat which have produced the largest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Advance	35	14	7. White Connell	32	58
2 Roumanian	34	36	8. White Fife	32	39
3. Wellman's Fife	34	18	9. Goose	32	32
4. Byron	34	10	10. Chester	32	27
5. Monarch	33	8	11. Crawford	32	25
6. Preston	32	58	12. Clyde	32	18

An average crop of 33 bushels 18 lbs. per acre.

The twelve varieties of spring wheat which have given the largest crops at the several experimental farms in 1903, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Advance	34	40	7. Robin's Rust Proof	28	20
2. Benton	30	20	8. Monarch	28	..
3. McKendry's Fife (Minn. 181)	30	20	9. White Connell	27	20
4. Preston	29	40	10. Hungarian	27	20
5. Minn. No. 163	29	20	11. White Fife	27	..
6. Wellman's Fife	29	..	12. Roumanian	27	..

An average crop of 29 bushels 2 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Byron	42	40	7. Crawford	36	40
2. Early Riga	42	..	8. Red Fife	36	40
3. Chester	40	..	9. Rio Grande	36	40
4. Wellman's Fife	38	..	10. Admiral	36	..
5. Essex	38	..	11. White Fife	36	..
6. Power's Fife (Minn. 149)	37	20	12. Laurel	36	..

An average crop of 38 bushels per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Goose	46	20	7. White Russian	30	40
2. Roumanian	44	40	8. Wellman's Fife	30	20
3. Australian No. 9	34	..	9. Dawn	30	20
4. Chester	33	30	10. Angus	30	..
5. Blair	31	30	11. Benton	29	20
6. Fraser	31	20	12. Percy	29	10

An average crop of 33 bushels 26 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Weldon	43	40	7. Stanley	39	10
2. Preston	43	10	8. Huron	39	..
3. Hungarian	42	..	9. Angus	38	50
4. Pringle's Champlain	41	40	10. Norval	38	45
5. Roumanian	41	..	11. Red Fife	38	30
6. Fraser	39	35	12. Hastings	38	20

An average crop of 40 bushels 18 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Percy	46	40	7. Monarch	41	20
2. Australian No. 19	44	..	8. Cartier	41	20
3. Advance	42	40	9. White Connell	41	10
4 Plumper	42	..	10. Wellman's Fife	41	..
5. Hastings	41	40	11. Clyde	41	..
6. Bishop	41	40	12. Alpha	40	50

An average crop of 42 bushels 7 lbs. per acre.

The average crop of all the varieties of spring wheat tested at each of the experimental farms in 1903, was as follows :—At Ottawa, 23 bushels 3 lbs. per acre; Nappan, 29 bushels 15 lbs. per acre ; Brandon, 26 bushels 46 lbs. ; Indian Head, 34 bushels 24 lbs.; and at Agassiz, 38 bushels 10 lbs. The average return given by the whole of the varieties of spring wheat at all the farms was 30 bushels 20 lbs. per acre.

EMMER ("SPELTZ")

The common variety of emmer, to which the incorrect name of Speltz is often given, was grown as usual at all the experimental farms this past season. In comparing the yield of this grain with wheat a deduction of twenty per cent or more must be made from the weight of the emmer on account of the husk, inasmuch as this grain retains its husk after ordinary threshing.

The following table shows the yield of common emmer obtained at each experimental farm ; and for comparison the highest yield of wheat at each farm is also inserted.

UNIFORM TEST PLOTS OF COMMON EMMER FOR 1903.

Where Grown.	Number of Days Maturing.	Yield per Acre as Threshed.	Estimated Yield per Acre of Clean Grain.			Highest Yield of Wheat Obtained.	
			In pounds.	In Bushels of 60 lbs. Each.			
		Lbs.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
Ottawa	117	1,300	1,040	17	20	34	40
Nappan	122	1,520	1,216	20	16	42	40
Brandon	127	2,630	2,104	35	4	46	20
Indian Head	143	3,280	2,624	43	44	46	..*
Agassiz	122	2,190	1,752	29	12	46	40

*This yield was obtained from a macaroni wheat known as Mahmoudi, a variety not yet tested at all the farms.

PEASE.

Forty varieties of pease have been under trial during the past season. The plots were of the same size as those sown with oats ; and the quantity of seed used per acre varied from two to three bushels, depending on the size of the pea. The dates of sowing were as follows :—At Ottawa, Ont., April 22, Nappan, N.S., May 9 ; Brandon, Man., April 24 to 27 ; Indian Head, N.W.T., May 5 ; and at Agassiz, B.C., April 21.

In Canada the bushel of pease is 60 lbs.

UNIFORM TEST PLOTS OF PEASE FOR 1903.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms.												Number of Days from Sowing to Harvesting.					
		Average of all Farms.		Ottawa, Ont.		Nappan, N. S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B. C.		Average.	Ottawa.	Nappan.	Brandon.	Indian Head.	Agassiz.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Days.	Days.	Days.	Days.	Days.	Days.
1	English Grey	44	8	34	20	34	..	63	..	55	50	33	30	124	121	128	129	126	116
2	*Macoun	43	42	23	..	38	40	57	..	55	30	44	20	124	120	124	129	131	116
3	Early Britain	43	14	24	40	24	..	60	20	60	30	46	40	121	122	122	118	126	116
4	*Archer	41	30	27	20	42	..	51	40	53	10	33	20	125	123	124	127	128	122
5	Crown	41	6	34	..	40	..	53	..	40	50	37	40	120	119	121	117	121	122
6	*Alma	41	4	26	..	31	20	64	40	50	10	33	10	124	117	122	126	134	123
7	German White	40	34	27	20	25	20	54	40	49	10	46	20	124	120	128	126	126	118
8	Pride	40	26	28	40	34	..	50	..	53	10	36	20	124	122	121	124	128	123
9	*Arthur	40	10	22	40	44	40	46	40	42	10	44	40	121	118	123	124	124	116
10	*Mackay	38	50	20	..	30	40	50	20	57	50	35	20	125	120	126	127	132	121
11	Wisconsin Blue	38	38	25	40	23	20	50	..	55	10	39	..	124	119	128	122	134	119
12	Mummy	38	26	30	..	37	20	45	20	37	30	42	..	122	122	123	124	124	119
13	*Pearl	38	26	25	20	24	40	54	..	45	30	42	40	124	119	126	129	126	121
14	Chancellor	38	23	30	20	..	†	41	40	37	30	44	..	120	118	†	115	124	121
15	Large White Marrowfat	38	4	27	20	29	20	43	40	43	30	46	30	123	119	123	128	124	122
16	*King	37	46	27	20	20	..	47	..	56	30	38	..	124	121	124	124	131	121
17	Black-eyed Marrowfat	37	36	22	40	28	..	48	..	56	30	38	50	125	118	124	130	128	123
18	*Agnes	37	30	23	..	35	20	43	..	46	50	39	20	122	119	123	125	121	122
19	Daniel O'Rourke	37	16	32	..	36	40	41	..	41	10	35	30	120	118	122	124	121	116
20	*Kent	36	56	29	..	26	..	45	20	49	10	35	10	126	123	127	129	132	119
21	*Gregory	36	48	30	40	28	40	34	20	59	10	31	10	125	120	129	126	130	119
22	Prussian Blue	36	44	33	40	25	20	34	..	55	50	34	50	122	118	123	124	126	121
23	*Paragon	36	42	31	20	13	20	38	40	60	..	40	10	125	117	124	129	130	123
24	*Victoria	36	26	31	20	26	..	54	40	38	10	32	..	126	125	127	132	128	119
25	*Carleton	36	22	23	..	30	..	33	40	49	50	45	20	126	123	124	130	134	118
26	Golden Vine	36	10	32	40	18	40	53	40	39	10	36	40	121	121	122	120	121	119
27	*Elliot	35	52	23	20	33	20	43	20	46	50	32	30	125	120	126	127	128	123
28	*Nelson	35	42	15	40	32	40	44	..	45	30	40	40	121	119	123	121	126	118
29	*Bruce	35	12	30	40	30	..	28	20	52	50	34	10	124	122	122	129	128	120
30	*Trilby	35	6	27	40	26	40	49	40	39	50	31	40	126	118	128	128	132	123
31	*Picton	35	2	31	.	16	40	46	40	48	30	32	20	123	122	122	126	124	121
32	*Perth	34	50	29	..	28	40	36	..	47	50	32	40	122	118	124	124	124	118
33	Prince Albert	34	44	26	20	27	20	47	..	37	30	35	30	123	119	121	129	126	119
34	New Potter	33	56	23	40	26	..	31	40	49	10	39	10	124	119	126	124	128	122
35	Centennial	33	4	20	40	30	40	27	40	44	50	41	30	124	122	124	127	126	119
36	*Duke	32	54	30	40	20	40	34	20	45	10	33	40	125	120	122	129	133	120
37	*Fergus	32	36	21	..	21	20	43	20	43	30	33	50	127	120	129	130	134	121
38	*Prince	31	54	26	20	18	..	37	..	45	10	33	..	124	123	123	129	126	121
39	White Wonder	30	58	22	40	13	20	47	20	31	30	40	..	118	116	122	116	115	122
40	*Lanark	30	54	23	20	20	..	24	..	44	50	42	20	123	119	127	129	126	116

* Cross-bred varieties produced at the Experimental Farms.
† Failed.

The twelve varieties of pease which have produced the largest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. English Grey	44	8	7. German White	40	34
2. Macoun	43	42	8. Pride	40	26
3. Early Britain	43	14	9. Arthur	40	10
4. Archer	41	30	10. Mackay	38	50
5. Crown	41	6	11. Wisconsin Blue	38	38
6. Alma	41	4	12. Mummy	38	26

An average crop of 40 bushels 59 lbs. per acre.

The twelve varieties of pease which have given the largest crops at the several experimental farms during 1903, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. English Grey	34	20	7. Victoria	31	20
2. Crown	34	..	8. Picton	31	..
3. Prussian Blue	33	40	9. Gregory	30	40
4. Golden Vine	32	40	10. Duke	30	40
5. Daniel O'Rourke	32	..	11. Bruce	30	40
6. Paragon	31	20	12. Chancellor	30	20

An average crop of 31 bushels 53 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Arthur	44	40	7. Agnes	35	20
2. Archer	42	..	8. English Grey	34	..
3. Crown	40	..	9. Pride	34	..
4. Macoun	38	40	10. Elliot	33	20
5. Mummy	37	20	11. Nelson	32	40
6. Daniel O'Rourke	36	40	12. Alma	31	20

An average crop of 36 bushels 40 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Alma	64	40	7. Pearl	54	..
2. English Grey	63	..	8. Golden Vine	53	40
3. Early Britain	60	20	9. Crown	53	..
4. Macoun	57	..	10. Archer	51	40
5. Victoria	54	40	11. Mackay	50	20
6. German White	54	40	12. Pride	50	..

An average crop of 55 bushels 35 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Early Britain..	60	30	7. Prussian Blue..	55	50
2. Paragon..	60	..	8. Macoun..	55	30
3. Gregory..	59	10	9. Wisconsin Blue....	55	10
4. Mackay..	57	50	10. Archer..	53	10
5. King..	56	30	11. Pride..	53	10
6. English Grey..	55	50	12. Bruce..	52	50

An average crop of 56 bushels 18 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Early Britain..	46	40	7. Chancellor..	44	..
2. Large White Marrowfat..	46	30	8. Pearl..	42	40
3. German White..	46	20	9. Lanark..	42	20
4. Carleton..	45	20	10. Mummy..	42	..
5. Arthur..	44	40	11. Centennial..	41	30
6. Macoun..	44	20	12. Nelson..	40	40

An average crop of 43 bushels 55 lbs. per acre.

The average crop of all the varieties of pease tested at each of the experimental farms in 1903, was as follows :—At Ottawa, 26 bushels 53 lbs. per acre ; Nappan, 28 bushels 1 lb. ; Brandon, 44 bushels 58 lbs. ; Indian Head, 47 bushels 40 lbs.; and at Agassiz, 37 bushels 53 lbs. The average return given by the whole of the varieties at all the farms was 37 bushels 6 lbs. per acre.

INDIAN CORN.

The number of varieties of corn tested in 1903 was twenty-three. These were all sown in rows three feet apart and the plants thinned out to six or eight inches apart in the rows. The dates of sowing were as follows :—At Ottawa, Ont., May 27 ; Nappan, N.S., June 2 ; Brandon, Man., May 28 ; Indian Head, N.W.T., May 22 ; and at Agassiz, B.C., May 20.

The crop in each case was cut green and put into the silo for the winter feeding of stock. The dates of cutting were :—At Ottawa, September 30 ; Nappan, October 6 ; Brandon, September 4 ; Indian Head, September 9 ; and at Agassiz, October 10. The yield per acre has been calculated in each case from the weight obtained from two rows each 66 feet long.

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF INDIAN CORN FOR 1903.

Number.	Name of Variety.	Yield per Acre at the Several Experimental Farms.											
		Average of all Farms.		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.	
		Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.	Per Acre. Tons.	Lbs.
1	Early Mastodon	21	1,699	27	835	17	650	21	768	18	300	24	1,940
2	Thoroughbred White Flint	21	112	17	1,200	16	1,330	28	232	18	300	24	1,500
3	Eureka	20	1,536	14	1,370	17	320	23	1,532	20	700	22	1,760
4	Angel of Midnight	19	1,076	13	180	13	950	19	1,072	25	600	26	580
5	Giant Prolific Ensilage	19	1,061	20	755	17	1,750	19	280	15	800	24	1,720
6	Superior Fodder	19	1,037	16	780	17	100	21	1,824	16	1,000	25	1,480
7	Red Cob Ensilage	19	504	17	100	17	870	19	1,072	11	....	31	480
8	Compton's Early	18	1,404	18	1,840	14	1,370	20	392	17	1,200	22	220
9	Champion White Pearl	18	689	18	355	14	600	24	312	14	1,700	20	480
10	Mammoth Cuban	18	656	19	1,600	14	1,150	19	1,072	13	1,500	23	1,960
11	Early Butler	18	269	19	280	14	270	19	1,336	15	1,900	21	1,560
12	Salzer's All Gold	17	1,658	15	1,460	15	800	14	248	19	500	24	1,280
13	North Dakota White	17	1,332	14	1,700	11	1,100	18	960	19	500	24	400
14	Longfellow	17	1,112	15	1,240	15	1,570	19	280	19	1,600	17	870
15	Pride of the North	17	912	19	500	12	530	15	1,680	13	1,500	26	350
16	Selected Leaming	17	346	17	1,970	18	850	18	432	13	460	18	80
17	Mammoth Eight-Rowed Flint	16	652	15	140	11	1,100	15	1,152	18	300	21	570
18	King Philip	16	278	11	1,100	14	600	18	1 752	15	1,900	20	40
19	King of the Earliest	16	263	21	955	14	50	15	360	12	1,300	17	650
20	Sanford	15	1,988	15	1,570	15	1,350	16	1,000	16	560	15	1,460
21	White Cap Yellow Dent	15	1,926	15	1,460	13	1,500	18	1,752	14	1,700	16	1,220
22	Cloud's Early Yellow	14	1,298	16	560	11	500	16	472	11	1,100	17	1,860
23	Evergreen Sugar	14	72	14	600	11	....	15	1,680	12	1,300	16	780

The six varieties of Indian corn which have given the heaviest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Mastodon..	21	1,699	4. Angel of Midnight..	19	1,076
2. Thoroughbred White Flint..	21	112	5. Giant Prolific Ensilage..	19	1,061
3. Eureka..	20	1,536	6. Superior Fodder	19	1,037

An average crop of 20 tons 753 lbs. per acre.

The six varieties of Indian corn which have given the heaviest crops at the several experimental farms during 1903, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Mastodon..	27	835	4. Mammoth Cuban..	19	1,600
2. King of the Earliest..	21	955	5. Pride of the North..	19	500
3. Giant Prolific Ensilage..	20	755	6. Early Butler..	19	280

An average crop of 21 tons 488 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs
1. Selected Leaming..	18	850	4. Early Mastodon..	..17	650
2. Giant Prolific Ensilage....	17	1,750	5. Eureka..	17	320
3. Red Cob Ensilage....	..17	870	6. Superior Fodder..	17	100

An average crop of 17 tons 1,090 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Eureka..	28	1,532	4. Superior Fodder	21	1,824
2. Thoroughbred White Flint..	28	232	5. Early Mastodon..	21	768
3. Champion White Pearl..	24	312	6. Compton's Early	20	392

An average crop of 24 tons 177 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Angel of Midnight..	25	600	4. North Dakota White..	19	500
2. Eureka..	20	700	5. Salzer's All Gold..	19	500
3. Longfellow..	19	1,000	6. Early Mastodon....	18	300

An average crop of 20 tons 700 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Cob Ensilage..	31	480	4. Superior Fodder	25	1,480
2. Angel of Midnight..	26	580	5. Early Mastodon..	24	1,940
3. Pride of the North..	26	350	6. Giant Prolific Ensilage..	24	1,720

An average crop of 26 tons 1,902 lbs. per acre.

The average weight of all the varieties, cut green, of Indian corn tested at each of the experimental farms in 1903, was as follows :—At Ottawa, 17 tons 459 lbs. per acre ; Nappan, 14 tons 1,535 lbs. ; Brandon, 19 tons 681 lbs. ; Indian Head, 16 tons 550 lbs ; and at Agassiz, 21 tons 1,880 lbs. The average return given by the whole of the varieties at all the farms was 17 tons 1,821 lbs. per acre.

TURNIPS.

Twenty-one varieties of turnips were tested in 1903, sown in drills or on the flat 2½ feet apart. Two sowings were made at each farm, the second sowing being about two weeks later than the first. The dates of sowing will be found in the accompanying table. The dates on which the roots were pulled were as follows :—At Ottawa, Ont., October 19 ; Nappan, N.S., October 27 ; Brandon, Man., October 7 ; Indian Head, N.W.T., October 9 ; and at Agassiz, B.C., October 24. The yield per acre in each case has been calculated from the weight of roots gathered from two rows, each 66 feet long.

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF TURNIPS FOR 1903.

Number.	Name of Variety.	Average of all Farms.		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.	
		First Sowing.	Second Sowing.	Sown May 7.	Sown May 21.	Sown May 15.	Sown May 29.	Sown May 30.	Sown June 13.	Sown May 16.	Sown May 28.	Sown May 13.	Sown May 27.
		Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.
1	Mammoth Clyde	38 1,596	28 628	41 665	30 1,545	47 1,040	38 1,055	41 1,160	16 1,000	21 1,956	16 1,000	41 1,160	39 540
2	New Century	38 659	26 1,955	47 1,865	23 1,850	47 50	38 725	39 672	14 1,040	17 848	18 960	39 1,860	39 1,200
3	Emperor Swede	38 131	27 1,845	37 1,570	20 425	47 710	40 25	38 560	14 1,568	19 544	26 8	47 1,270	38 1,200
4	Jumbo	36 1,854	26 1,130	46 235	24 1,665	44 1,925	37 745	32 680	16 1,000	22 1,540	15 360	38 890	38 1,880
5	Hartley's Bronze	36 1,219	31 957	29 245	27 780	41 1,490	35 455	38 560	22 880	*	32 152	37 580	40 520
6	Perfection Swede	36 118	29 1,928	25 1,975	24 1,005	50 320	43 625	35 1,280	16 1,000	22 1,936	29 80	45 1,080	36 930
7	Good Luck	35 1,518	28 1,750	40 1,510	28 1,090	44 1,760	41 500	36 864	14 1,040	14 1,964	22 880	41 1,490	37 1,240
8	Drummond Purple Top	35 1,260	26 727	33 990	30 225	43 1,120	35 125	42 480	14 1,040	21 1,956	18 1,752	36 1,755	33 495
9	Kangaroo	35 1,062	26 1,712	44 1,430	24 1,005	47 875	34 1,795	39 1,200	17 320	10 196	22 1,808	35 1,610	34 1,630
10	Elephant's Master	34 1,960	26 1,427	33 1,155	20 260	48 30	37 910	40 1,312	15 1,580	12 948	23 1,520	40 355	36 765
11	Sutton's Champion	34 1,754	28 522	26 1,625	24 1,830	39 1,530	38 1,550	39 1,200	15 360	*	25 952	33 660	36 1,920
12	Imperial Swede	34 1,333	30 1,583	30 390	29 740	43 955	37 85	40 520	19 1,600	17 980	28 238	41 1,820	39 1,200
13	Hall's Westbury	34 396	28 1,057	23 695	19 1,270	41 1,820	37 1,735	39 1,200	21 240	23 464	27 1,440	42 1,800	36 600
14	Halewood's Bronze Top	34 383	28 701	23 1,520	21 1,890	48 1,845	34 1,465	38 1,880	17 320	19 148	26 1,328	40 520	41 500
15	Skirvings	34 171	29 73	25 1,480	19 445	44 605	38 1,550	40 520	20 920	22 1,012	31 832	37 1,240	35 620
16	Magnum Bonum	34 79	28 1,961	30 555	24 345	49 1,000	41 1,390	43 1,120	18 960	13 400	23 1,520	33 1,320	36 1,590
17	Selected Purple Top	33 1,881	28 667	29 575	28 1,915	47 1,370	40 955	40 520	16 736	20 1,580	18 488	31 1,360	37 1,240
18	Bangholm Selected	33 1,373	25 1,044	29 905	24 15	46 235	35 455	34 1,960	15 360	18 1,884	21 1,032	38 1,880	31 1,360
19	Shamrock Purple Top	33 500	26 1,328	33 825	26 965	41 1,325	35 1,115	36 600	19 280	19 1,792	19 1,600	34 1,960	32 680
20	East Lothian	32 1,122	27 1,367	23 1,520	23 860	41 665	36 435	36 1,920	15 1,680	15 96	24 312	45 1,410	38 1,550
21	Carter's Elephant	32 924	24 1,500	27 120	17 320	39 1,365	32 680	38 560	14 1,040	20 1,316	21 240	36 1,260	38 1,220

* Destroyed by turnip fly.

The six varieties of turnips which have given the heaviest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth Clyde..	38	1,596	4. Jumbo..	36	1,854
2. New Century..	38	659	5. Hartley's Bronze..	36	1,219
3. Emperor Swede..	38	131	6. Perfection Swede..	36	118

An average crop of 37 tons 929 lbs. per acre.

The six varieties of turnips which have given the heaviest crops at the several experimental farms during the season of 1903, are the following :—

(Where not otherwise stated the quantities given are all from the early sown plots.)

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New Century..	47	1,865	4. Mammoth Clyde..	41	665
2. Jumbo..	46	235	5. Good Luck..	40	1,510
3. Kangaroo..	44	1,430	6. Emperor Swede....	37	1,570

An average crop of 43 tons 213 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Perfection Swede..	50	320	4. Elephant's Master..	48	30
2 Magnum Bonum..	49	1,000	5. Selected Purple Top..	47	1,370
3. Halewood's Bronze Top..	48	1,845	6. Mammoth Clyde..	47	1,040

An average crop of 48 tons 1,268 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Magnum Bonum..	43	1,120	4. Elephant's Master..	40	1,312
2. Drummond Purple Top..	42	480	5. Selected Purple Top..	40	520
3. Mammoth Clyde..	41	1,160	6. Skirvings....	40	520

An average crop of 41 tons 852 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Hartley's Bronze (2nd sowing)....	32	152	4. Imperial Swede (2nd sowing)....	28	288
2. Skirvings (2nd sowing)..	31	832	5. Hall's Westbury (2nd sowing)..	27	1,440
3. Perfection Swede (2nd sowing)....	29	80	6. Halewood's Bronze Top (2nd sowing)....	26	1,328

An average crop of 29 tons 353 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Emperor Swede..	47	1,270	4. Hall's Westbury..	42	1,800
2. East Lothian..	45	1,410	5. Imperial Swede..	41	1,820
3. Perfection Swede..	45	1,080	6. Good Luck..	41	1,490

An average crop of 44 tons 478 lbs. per acre.

The crops from the two sowing of turnips at the experimental farms in 1903 have averaged per acre, as follows :—

	Tons.	Lbs.
Central Experimental Farm, first sowing....	32	1,126
" " second sowing..	24	974
Experimental Farm, Nappan, first sowing....	45	192
" Nappan, second sowing....	37	1,256
" Brandon, first sowing....	38	1,465
" Brandon, second sowing..	16	1,955
" Indian Head, first sowing	18	1,345
" Indian Head, second sowing.. ..	23	1,407
" Agassiz, first sowing....	39	347
" Agassiz, second sowing..	37	328

The average crop from all the plots at all the farms was, for the first sowing, 34 tons 1,695 lbs., and for the second sowing, 27 tons 1,984 lbs.; showing an advantage in favour of the first sowing of 6 tons 1,711 lbs. per acre. It will be seen that the early sown plots have given the larger crops at all the farms except at Indian Head, N.W.T.

MANGELS.

Sixteen varieties of mangels have been under test during 1903. All were sown in drills or on the flat in rows 2½ feet apart. Two sowings were made at each farm, the second sowing being about two weeks later than the first. The dates of sowing will be found in the accompanying table. The dates on which the roots were pulled were as follows :—At Ottawa, Ont., October 19 ; Nappan, N.S., October 21 ; Brandon, Man., September 21 ; Indian Head, N.W.T., October 8 ; and at Agassiz, B.C., October 22. The yield per acre has been calculated in each case from the weight of roots gathered from two rows, each 66 feet long.

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF MANGELS FOR 1903.

Number.	Name of Variety.	Average of all Farms.		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N. W. T.		Agassiz, B.C.	
		First Sowing.	Second Sowing.	Sown May 7.	Sown May 21.	Sown May 15.	Sown May 29.	Sown May 30.	Sown June 13.	Sown May 14.	Sown May 26.	Sown April 28.	Sown May 12.
		Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.
1	Mammoth Long Red	39 1,761	31 1,479	41 335	21 900	41 5	36 1,755	42 744	23 1,520	26 536	29 1,664	48 1,185	46 1,555
2	Mam. Yellow Intermediate.	37 936	27 886	34 1,630	15 1,845	46 1,225	37 745	33 1,320	24 1,368	32 812	24 840	39 1,695	34 1,620
3	Half Long Sugar White ...	36 1,102	27 1,836	35 620	15 1,350	40 1,675	30 1,710	36 1,392	28 760	29 1,796	17 1,968	40 25	46 1,380
4	Selected Yellow Globe.....	36 290	26 513	39 375	17 815	45 90	35 475	27 1,704	23 728	29 80	19 608	39 1,200	35 1,940
5	Giant Yellow Intermediate	35 1,392	28 1,493	34 475	17 815	45 1,575	36 600	25 160	23 992	33 1,716	28 496	39 1,035	38 560
6	Lion Yellow Intermediate .	35 910	26 1,834	30 225	19 1,435	46 235	41 5	29 1,400	22 880	32 152	17 1,704	39 540	33 1,145
7	Prize Winner Yellow Globe	34 515	25 1,132	32 845	18 630	43 1,450	37 415	31 1,360	21 1,560	28 1,948	18 1,552	34 970	31 1,505
8	Triumph Yellow Globe	34 272	24 109	40 190	18 1,125	41 1,325	30 225	33 1,584	20 656	26 800	24 576	28 1,460	26 1,965
9	Selected Mamm. Long Red.	33 838	29 714	24 1,500	22 385	43 1,120	39 1,365	32 1,736	23 1,784	28 496	26 1,064	37 1,340	34 970
10	Prize Mamm. Long Red...	33 638	26 1,500	32 350	20 1,250	45 255	37 1,240	32 1,472	22 88	26 1,592	25 1,480	29 1,520	27 1,440
11	Half Long Sugar Rosy.....	33 634	24 1,671	29 740	14 215	41 170	32 185	27 912	20 1,712	27 516	18 1,024	41 830	38 1,220
12	Giant Yellow Globe.....	32 297	26 1,592	25 1,645	16 1,990	45 585	36 1,425	25 1,480	21 1,560	29 1,796	30 720	33 1,980	28 265
13	Gate Post.....	31 1,730	24 840	34 1,795	20 1,580	32 1,670	22 550	27 1,968	23 200	29 1,400	19 1,600	33 1,315	36 270
14	Yellow Intermediate.....	31 396	24 130	29 1,730	14 495	40 850	32 1,175	30 720	20 712	28 892	26 800	26 1,790	26 1,470
15	Giant Sugar Mangel.	31 264	24 1,764	34 1,135	15 1,680	33 495	25 985	27 912	20 1,712	25 1,480	24 1,104	34 1,300	37 1,340
16	Leviathan Long Red.....	29 318	25 503	23 200	13 1,885	42 1,800	35 125	28 232	18 960	24 1,236	27 1,176	27 120	31 370

The six varieties of mangels which have given the heaviest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth Long Red..	39	1,761	4. Selected Yellow Globe..	36	290
2. Mamm. Yellow Intermediate.. ..	37	936	5. Giant Yellow Intermediate..	35	1,392
3. Half Long Sugar White..	36	1,102	6. Lion Yellow Intermediate..	35	910

An average crop of 36 tons 1,732 lbs. per acre.

The six varieties of mangels which have produced the heaviest crops at the several experimental farms during 1903, are the following. (Unless otherwise stated the yields given are all from the earliest sown plots) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth Long Red..	41	335	4. Half Long Sugar White..	35	620
2. Triumph Yellow Globe..	40	190	5. Gate Post..	34	1,795
3. Selected Yellow Globe..	39	375	6. Mammoth Yellow Intermediate..	34	1,630

An average crop of 37 tons, 1,158 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth Yellow Intermediate ..	46	1,225	4. Giant Yellow Globe..	45	585
2. Lion Yellow Intermediate	46	235	5. Prize Mammoth Long Red..	45	255
3. Giant Yellow Intermediate..	45	1,575	6. Selected Yellow Globe..	45	90

An average crop of 45 tons, 1,328 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth Long Red..	42	744	4. Mammoth Yellow Intermediate ..	33	1,320
2. Half Long Sugar White..	36	1,392	5. Selected Mammoth Long Red.. ..	32	1,736
3. Triumph Yellow Globe..	33	1,584	6. Prize Mammoth Long Red..	32	1,472

An average crop of 35 tons, 708 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1 Giant Yellow Intermediate..	33	1,716	4. Giant Yellow Globe (2nd sowing).	30	720
2. Mammoth Yellow Intermediate ..	32	812	5. Half Long Sugar White..	29	1,796
3. Lion Yellow Intermediate..	32	152	6. Mammoth Long Red (2nd sowing)	29	1,664

An average crop of 31 tons 810 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth Long Red....	48	1,185	4. Mammoth Yellow Intermediate ..	39	1,695
2. Half Long Sugar White (2nd sowing)..	46	1,390	5. Selected Yellow Globe..	39	1,200
3. Half Long Sugar Rosy..	41	830	6. Giant Yellow Intermediate..	39	1,035

An average crop of 42 tons 1,223 lbs. per acre.

The crops from the two sowings of mangels at the experimental farms in 1903, have averaged per acre as follows :—

	Tons.	Lbs.
Central Experimental Farm, first sowing	32	1,237
" " second sowing	17	1,400
Experimental Farm, Nappan, first sowing	42	408
" Nappan, second sowing	34	311
" Brandon, first sowing	30	1,694
" Brandon, second sowing	22	949
" Indian Head, first sowing	28	1,453
" Indian Head, second sowing	23	1,523
" Agassiz, first sowing	35	1,925
" Agassiz, second sowing	34	1,439

The average crop from all the plots at all the farms was, from the first sowing, 34 tons 134 lbs., and from the second sowing, 26 tons 1,124 lbs.; showing an advantage in favour of early sowing of 7 tons 1,019 lbs. per acre.

CARROTS

Eleven different sorts of carrots were tested during 1903, all being sown in drills or on the flat two feet apart. Two sowings were made in each case, the second sowing being two weeks later than the first. The dates of sowing will be found in the accompanying table. The dates on which the carrots were pulled were as follows :—At Ottawa, Ont., October 19 ; Nappan, N.S., October 27 ; Brandon, Man., October 19 ; Indian Head, N.W.T., October 12 ; and at Agassiz, B.C., October 27.

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF CARROTS FOR 1903.

Number.	Name of Variety.	Average of all Farms.		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head, N.W.T.		Agassiz, B.C.	
		First Sowing.	Second Sowing.	Sown May 7.	Sown May 21.	Sown May 15.	Sown May 29.	Sown May 16.	Sown June 6.	Sown May 2.	Sown May 16.	Sown April 27.	Sown May 11.
		Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.	Per Acre. Tons. Lbs.
1	Ontario Champion	23 352	18 993	29 1,070	22 550	30 225	22 1,375	21 240	11 1,760	10 64	9 1,800	25 160	25 1,480
2	Giant White Vosges	23 273	18 1,796	29 80	21 570	29 905	19 1,600	15 1,680	12 1,300	9 1,008	12 1,080	31 1,690	28 430
3	Mamm. White Intermediate	22 1,573	18 134	30 1,875	22 1,210	27 615	24 675	14 1,700	8 60	8 500	8 1,100	32 1,175	26 1,625
4	New White Intermediate	21 1,309	17 857	33 1,815	25 160	24 675	22 880	21 240	10 900	9 876	11 704	19 940	17 1,640
5	Improved Short White	21 975	17 1,024	28 430	20 755	20 1,580	20 920	22 1,320	12 640	9 1,404	9 1,800	26 140	24 1,005
6	White Belgian	19 1,534	16 241	27 1,110	19 1,930	18 1,950	17 155	17 1,640	10 1,780	9 1,140	10 1,120	24 1,830	22 220
7	Half Long Chantenay	18 1,178	14 1,363	21 75	16 175	23 200	18 300	17 320	10 1,120	12 684	10 1,912	19 610	17 1,310
8	Long Yellow Stump Rooted	17 1,930	15 1,595	26 1,810	18 300	22 880	21 1,375	10 900	11 1,320	9 1,140	8 1,688	20 920	18 1,290
9	Half Long White	17 599	15 1,948	21 1,890	20 1,745	19 445	18 1,620	16 1,440	8 720	7 652	9 1,272	21 570	22 385
10	Carter's Orange Giant	16 1,455	15 228	21 1,065	18 135	17 650	15 1,350	11 880	9 1,800	9 1,820	9 1,800	23 860	22 55
11	Early Gem	16 410	14 1,315	16 1,495	15 1,020	19 1,105	19 445	14 600	11 1,320	11 1,892	8 1,160	18 960	18 630

The six varieties of carrots which have given the heaviest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Ontario Champion..	23	352	4. New White Intermediate..	21	1,309
2. Giant White Vosges..	23	273	5. Improved Short White..	21	975
3. Mamm. White Intermediate..	22	1,573	6. White Belgian..	19	1,534

An average crop of 22 tons 8 lbs. per acre.

The six varieties of carrots which have produced the heaviest crops at the several experimental farms during the season of 1903, are the following. (Unless otherwise stated, the yields given are all from the earliest sown plots) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate..	33	1,815	4. Giant White Vosges..	29	80
2. Mammoth White Intermediate....	30	1,875	5. Improved Short White..	28	430
3. Ontario Champion..	29	1,070	6. White Belgian..	27	1,110

An average crop of 29 tons 1,730 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Ontario Champion..	30	225	4. New White Intermediate..	24	675
2. Giant White Vosges..	29	905	5. Half Long Chantenay	23	200
3. Mammoth White Intermediate....	27	615	6. Long Yellow Stump Rooted.. ..	22	880

An average crop of 26 tons 250 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Improved Short White....	22	1,320	4. White Belgian..	17	1,640
2. New White Intermediate....	21	240	5. Half Long Chantenay....	17	320
3. Ontario Champion..	21	240	6. Half Long White..	16	1,440

An average crop of 19 tons 867 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant White Vosges (2nd sowing).	12	1,080	4. New White Intermediate (2nd sowing)..	11	704
2. Half Long Chantenay..	12	684	5. White Belgian (2nd sowing).. ..	10	1,120
3. Early Gem..	11	1,892	6. Ontario Champion..	10	64

An average crop of 11 tons 924 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Mammoth White Intermediate....	32	1,175	4. Ontario Champion (2nd sowing)..	25	1,480
2. Giant White Vosges..	31	1,690	5. White Belgian..	24	1,830
3. Improved Short White..	26	140	6. Carter's Orange Giant..	23	860

An average crop of 27 tons 863 lbs. per acre.

The crops from the two sowings of carrots at the experimental farms in 1903, have averaged as follows :—

	Tons.	Lbs.
Central Experimental Farm, first sowing....	26	247
" " second sowing..	20	50
Experimental Farm, Nappan, first sowing....	22	1,930
" Nappan, second sowing..	20	63
" Brandon, first sowing....	16	1,360
" Brandon, second sowing..	10	1,520
" Indian Head, first sowing...	9	1,562
" Indian Head, second sowing	10	131
" Agassiz, first sowing....	23	1,805
" Agassiz, second sowing..	22	370

The average crop from all the plots at all the farms was, from the first sowing, 19 tons 1,781 lbs., and from the second sowing, 16 tons 1,227 lbs.; showing an advantage in favour of the early sown plots of 3 tons 554 lbs. per acre.

SUGAR BEETS.

Eight varieties of sugar beets have been tested during 1903, sown in drills or on the flat two feet apart. Two sowings were made at each farm, the second sowing being about two weeks later than the first. The dates of sowing will be found in the accompanying table. The dates on which the roots were pulled were as follows :—At Ottawa, Ont., October 19 ; Nappan, N.S., October 22 ; Brandon, Man., September 21 ; Indian Head, N.W.T., October 9 ; and at Agassiz, B.C., October 23. The yield per acre in each instance has been calculated from the weight of roots gathered from two rows, each 66 feet long.

Though all the varieties mentioned in the table are commonly classed as sugar beets it should be noted that the only sorts recommended for use in the manufacture of beet sugar are Wanzleben, Vilmorin's Improved, and French 'Very Rich.'

In Canada the ton is 2,000 lbs.

UNIFORM TEST PLOTS OF SUGAR BEETS FOR 1903.

Number.	Name of Variety.	Average of all Farms.				Ottawa, Ont.				Nappan, N.S.				Brandon, Man.				Indian Head, N.W.T.				Agassiz, B.C.			
		First Sowing.		Second Sowing.		Sown May 7.		Sown May 21.		Sown May 15.		Sown May 29.		Sown June 1.		Sown June 15.		Sown May 15.		Sown May 26.		Sown April 23.		Sown May 12.	
		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.		Per Acre.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Red Top Sugar	28	1,594	22	636	36	105	20	920	29	575	19	445	24	312	20	920	25	1,559	22	1,144	28	1,420	28	1,750
2	Improved Imperial	28	1,347	25	88	39	540	21	900	28	595	18	1,620	22	1,936	21	504	26	866	23	1,024	26	800	35	800
3	Danish Red Top	28	1,334	21	359	35	455	16	1,495	31	40	21	1,395	25	160	19	1,600	24	1,896	22	1,144	27	120	25	160
4	Danish Improved	26	866	21	405	32	1,010	15	690	28	265	22	1,375	23	464	16	1,000	21	1,956	23	1,520	26	635	27	1,440
5	Royal Giant	26	120	22	741	20	1,250	15	1,185	37	415	30	390	19	1,600	21	504	26	866	18	828	26	470	26	800
6	Wanzleben	22	1,709	18	280	29	1,565	13	70	24	1,005	20	425	20	128	15	360	21	886	21	1,956	18	960	20	500
7	Vilmorin's Improved	21	637	19	1,514	19	610	7	1,180	28	925	24	675	13	1,456	14	776	21	1,005	29	1,400	23	1,120	22	1,540
8	French 'Very Rich'	19	1,603	17	881	23	695	13	1,455	21	75	17	650	13	1,720	13	1,720	21	1,243	14	1,700	19	220	23	800

The four varieties of sugar beets which have given the heaviest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Top Sugar..	28	1,594	3. Danish Red Top..	28	1,334
2. Improved Imperial..	28	1,347	4. Danish Improved..	26	866

An average crop of 28 tons 285 lbs. per acre.

The four varieties of sugar beets which have produced the heaviest crops at the several experimental farms during the season of 1903, are the following. (Unless otherwise stated, the yields given are all from the earliest sown plots) :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs		Per acre. Tons.	Lbs.
1. Improved Imperial..	39	540	3. Danish Red Top..	35	455
2. Red Top Sugar..	36	105	4. Danish Improved..	32	1,010

An average crop of 35 tons 1,528 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Royal Giant..	37	415	3. Red Top Sugar..	29	575
2. Danish Red Top..	31	40	4. Vilmorin's Improved..	28	925

An average crop of 31 tons, 989 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top....	25	160	3. Danish Improved..	23	464
2. Red Top Sugar..	24	312	4. Improved Imperial..	22	1,936

An average crop of 23 tons 1,718 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Vilmorin's Improved (2nd sowing)	29	1,400	3. Royal Giant..	26	866
2. Improved Imperial (2nd sowing)..	28	1,024	4. Red Top Sugar..	25	1,559

An average crop of 27 tons 1,212 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Improved Imperial (2nd sowing)..	35	390	3. Danish Improved (2nd sowing) ..	27	1,440
2. Red Top Sugar (2nd sowing)	28	1,750	4. Danish Red Top..	27	120

An average crop of 29 tons 1,425 lbs. per acre.

The crops from the two sowings of sugar beets at the experimental farms in 1903, have averaged as follows :—

	Tons.	Lbs.
Central Experimental Farm, first sowing....	29	1,029
" " second sowing	16	237
Experimental Farm, Nappan, first sowing..	28	987
" Nappan, second sowing..	21	1,622
" Brandon, first sowing..	20	722
" Brandon, second sowing..	17	1,673
" Indian Head, first sowing..	23	1,533
" Indian Head, second sowing.. ..	22	1,577
" Agassiz, first sowing..	24	984
" Agassiz, second sowing..	26	194

The average crop from all the plots at all the farms was, from the first sowing, 25 tons 651 lbs, and from the second sowing, 20 tons 1,861 lbs.; showing an advantage in favour of the first sowing of 4 tons 790 lbs. per acre.

POTATOES.

Fifty-five varieties of potatoes have been under test during 1903. The potatoes planted were cut into pieces with two or three eyes in each, and these were planted in rows 2½ feet apart, the sets being placed a foot apart in the rows. The following were the dates of planting and digging :—At Ottawa, Ont., planted May 22, dug October 5 and 6 ; at Nappan, N.S., planted May 22, dug September 25 ; at Brandon, Man., planted May 21, dug October 16 and 17 ; at Indian Head, N.W.T., planted May 14, dug October 5 ; and at Agassiz, B.C., planted May 19, dug September 22.

At the Central Experimental Farm the sets of some of the early varieties dried up in the ground from the excessive drought in spring. This accounts for the small yield reported this year in the case of some varieties which in past years have done well.

In Canada the bushel of potatoes is 60 lbs.

UNIFORM TEST PLOTS OF POTATOES FOR 1903.

Number.	Name of Variety.	Yield at the Several Experimental Farms.											
		Average of all Farms.		Ottawa, Ont.		Nappan, N.S.		Brandon, Man.		Indian Head N.W.T.		Agassiz, B.C.	
		Per Acre. Bush.	Lbs.	Per Acre. Bush.	Lbs.	Per Acre. Bush.	Lbs.	Per Acre. Bush.	Lbs.	Per Acre. Bush.	Lbs.	Per Acre. Bush.	Lbs.
1	Seedling No. 7	448	39	356	24	528	..	487	40	523	36	347	36
2	Vanier	444	54	358	36	550	..	425	20	514	21	376	12
3	Rose No. 9	432	21	398	12	378	24	429	..	597	31	358	36
4	Rochester Rose	430	3	305	48	495	..	341	..	542	4	466	24
5	Carman No. 1	429	2	514	48	226	36	399	40	711	28	292	36
6	Enormous	426	13	363	..	506	..	509	40	508	12	244	12
7	Late Puritan	425	30	473	..	407	..	430	50	517	26	299	12
8	Burnaby Seedling	417	39	418	..	411	24	429	..	548	14	281	36
9	Everett	417	24	393	48	433	24	447	20	575	57	236	30
10	Uncle Sam	415	13	393	48	308	..	498	40	554	24	321	12
11	Canadian Beauty	409	47	451	..	312	24	469	20	585	12	231	..
12	Pearce	409	42	334	24	605	..	407	..	357	16	344	48
13	Penn. Manor	403	8	347	36	418	..	407	..	532	50	310	12
14	Dreer's Standard	402	29	534	36	259	36	414	20	480	28	323	24
15	Delaware	401	24	301	24	330	..	586	40	535	55	253	..
16	Swiss Snowflake	398	21	305	48	404	48	414	20	554	24	312	24
17	State of Maine	397	19	387	12	345	24	484	..	508	12	261	48
18	I X L	396	1	367	24	363	..	414	20	542	4	293	18
19	Cambridge Russet	390	50	369	36	231	..	465	40	428	7	459	48
20	Troy Seedling	390	8	374	..	429	..	377	40	492	48	277	12
21	Maule's Thoroughbred	389	13	266	12	374	..	440	..	551	19	314	36
22	Country Gentleman	389	6	347	36	228	48	447	20	523	36	398	12
23	McIntyre	386	31	253	..	517	..	388	40	498	57	275	..
24	Early Norther	385	..	310	12	365	12	462	..	508	12	279	24
25	Irish Daisy	379	4	288	12	294	48	484	..	483	33	344	48
26	Clay Rose	377	56	418	..	492	48	355	40	391	7	232	6
27	Irish Cobbler	375	44	338	48	358	36	447	20	443	31	290	24
28	Vick's Extra Early	373	42	299	12	534	36	315	20	477	24	242	..
29	American Wonder	371	48	169	24	248	36	495	..	585	12	360	48
30	Holborn Abundance	370	1	261	48	297	..	436	20	597	31	257	24
31	Sharpe's Seedling	364	54	193	36	341	..	425	20	508	12	356	24
32	Reeves' Rose	364	24	272	48	242	..	451	..	455	50	400	24
33	American Giant	362	11	411	24	235	24	414	20	560	33	189	12
34	Money Maker	358	29	396	..	272	48	480	20	403	28	239	48
35	Lee's Favourite	354	14	312	24	222	12	432	40	603	40	200	12
36	Brown's Rot Proof	348	11	305	48	286	..	447	20	385	..	316	48
37	General Gordon	347	38	180	24	222	12	630	40	511	16	193	36
38	Early Michigan	346	24	268	24	202	24	410	40	489	43	360	48
39	Early Puritan	346	17	189	12	367	24	462	..	446	36	266	12
40	Empire State	345	27	180	24	314	36	451	..	597	31	183	44
41	Prolific Rose	342	24	162	48	250	48	418	..	563	38	316	48
42	Early Sunrise	334	52	169	24	228	48	377	40	649	52	248	36
43	Green Mountain	334	49	259	36	308	..	451	..	369	36	285	54
44	Sabean's Elephant	333	1	330	..	301	24	366	40	455	50	211	12
45	Early Rose	332	35	209	..	253	..	335	30	489	43	375	40
46	Early St. George	322	31	121	..	231	..	330	..	631	24	299	12
47	Burpee's Extra Early	321	53	319	..	202	24	311	40	542	4	234	18
48	Rawdon Rose	318	18	202	24	198	.	440	..	434	16	316	48
49	Carman No. 3	305	46	253	..	270	36	381	20	428	7	195	48
50	Early Andes	303	4	33	..	310	12	363	..	575	57	233	12
51	Early Envoy	303	2	283	48	407	..	271	20	326	28	226	36
52	Early White Prize	295	9	57	12	264	..	418	..	468	9	268	24
53	Bovee	281	25	103	24	347	36	319	..	351	7	286	..
54	Up to Date	236	51	180	24	336	36	258	30	267	57	140	48
55	Pingree	208	29	37	24	325	36	113	40	357	16	*	

* Not planted.

The twelve varieties of potatoes which have produced the largest crops in 1903, taking the average of the results obtained on all the experimental farms, are the following :—

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Seedling No. 7	448	39	7. Late Puritan	425	30
2. Vanier	444	54	8. Burnaby Seedling	417	39
3. Rose No. 9	432	21	9. Everett	417	24
4. Rochester Rose	430	3	10. Uncle Sam	415	13
5. Carman No. 1	429	2	11. Canadian Beauty	409	47
6. Enormous	426	13	12. Pearce	409	42

An average crop of 425 bushels 32 lbs per acre.

The twelve varieties of potatoes which have produced the largest crops at the several experimental farms during the season of 1903, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Dreer's Standard	534	36	7. American Giant	411	24
2. Carman No. 1	514	48	8. Rose No. 9	398	12
3. Late Puritan	473	..	9. Money Maker	396	..
4. Canadian Beauty	451	..	10. Uncle Sam	393	48
5. Clay Rose	418	..	11. Everett	393	48
6. Burnaby Seedling	418	..	12. State of Maine	387	12

An average crop of 432 bushels 29 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Pearce	605	..	7. Rochester Rose	495	..
2. Vanier	550	..	8. Clay Rose	492	48
3. Vick's Extra Early	534	36	9. Everett	433	24
4. Seedling No. 7	528	..	10. Troy Seedling	429	..
5. McIntyre	517	..	11. Penn Manor	418	..
6. Enormous	506	..	12. Burnaby Seedling	411	24

An average crop of 493 bushels 21 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. General Gordon	630	40	7. Irish Daisy	484	..
2. Delaware	586	40	8. State of Maine	484	..
3. Enormous	509	40	9. Money Maker	480	20
4. Uncle Sam	498	40	10. Canadian Beauty	469	20
5. American Wonder	495	..	11. Cambridge Russet	465	40
6. Seedling No. 7	487	40	12. Early Puritan	462	..

An average crop of 504 bushels 28 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Garman No. 1	711	28	7. Empire State	597	31
2. Early Sunrise	649	52	8. American Wonder	585	12
3. Early St. George	631	24	9. Canadian Beauty	585	12
4. Lee's Favourite	603	40	10. Early Andes	575	57
5. Holborn Abundance	597	31	11. Everett	575	57
6. Rose No. 9	597	31	12. Prolific Rose	563	38

An average crop of 606 bushels 14 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Rochester Rose	466	24	7. American Wonder	360	48
2. Cambridge Russet	459	48	8. Early Michigan	360	48
3. Reeves' Rose	400	24	9. Rose No. 9	358	36
4. Country Gentleman	393	12	10. Sharpe's Seedling	356	24
5. Vanier	376	12	11. Seedling No. 7	347	36
6. Early Rose	375	40	12. Irish Daisy	344	48

An average crop of 383 bushels 48 lbs. per acre.

The average crops of all the varieties of potatoes tested in 1903, at each of the experimental farms, were as follows :—At Ottawa, 293 bushels 19 lbs. per acre ; at Nappan, 338 bushels 5 lbs. per acre ; at Brandon, 415 bushels 50 lbs. per acre ; at Indian Head, 500 bushels 48 lbs. per acre ; and at Agassiz, 289 bushels 29 lbs. per acre.

The average return given by the whole of the varieties at all the farms was 365 bushels 30 lbs. per acre.

AVERAGE OF CROPS ON THE EXPERIMENTAL PLOTS FOR A SERIES OF YEARS.

The results of experiments with different varieties of agricultural crops to ascertain their relative productiveness become much more reliable and conclusive when the average experience of a series of years can be given. In this way variations arising from inequality of soil and variability of season are to a large extent equalized, and the conclusions reached become a more valuable guide to the farmer in selecting his seed. The experience here recorded with the varieties under test covers a period of from four to nine years.

TEST OF VARIETIES OF OATS FOR A SERIES OF YEARS.

The twelve varieties of oats which have produced the largest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the bushel of oats is 34 lbs.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Danish Island, 6 yrs..	79	3	7. Thousand Dollar, 6 yrs..	75	22
2. Banner, 9 yrs..	78	25	8. Black Beauty, 5 yrs..	75	14
3. Mennonite, 8 yrs..	77	3	9. Holstein Prolific, 9 yrs..	75	13
4. New Zealand, 5 yrs..	76	33	10. Improved American, 6 yrs..	75	12
5. American Beauty, 8 yrs..	75	29	11. Buckbee's Illinois, 8 yrs..	74	18
6. White Giant, 6 yrs..	75	27	12. Golden Tartarian, 7 yrs..	74	13

An average crop for the twelve varieties of 76 bushels 6 lbs. per acre.

The twelve varieties of oats which have averaged the heaviest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. White Giant, 6 yrs..	69	2	7. Holstein Prolific, 9 yrs..	63	31
2. Banner, 9 yrs..	68	6	8. Golden Beauty, 9 yrs..	63	28
3. Mennonite, 8 yrs..	65	19	9. Joanette, 9 yrs..	63	8
4. American Triumph, 9 yrs..	64	28	10. Abundance, 9 yrs..	61	31
5. Columbus, 9 yrs..	64	19	11. Improved Ligowo, 9 yrs..	61	30
6. Golden Giant, 9 yrs..	64	8	12. American Beauty, 9 yrs..	61	30

An average crop for the twelve varieties of 64 bushels 16 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Salines, 5 yrs..	80	24	7. Wallis, 9 yrs..	76	21
2. Siberian, 7 yrs..	79	17	8. New Zealand, 5 yrs..	76	16
3. Mennonite, 8 yrs..	78	10	9. White Giant, 6 yrs..	76	3
4. Thousand Dollar, 5 yrs..	78	4	10. Lincoln, 9 yrs..	75	25
5. Black Beauty, 5 yrs..	78	4	11. White Schonen, 9 yrs..	74	25
6. Danish Island, 6 yrs..	77	19	12. Banner, 9 yrs..	74	13

An average crop for the twelve varieties of 77 bushels 7 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Buckbee's Illinois, 6 yrs..	92	4	7. Early Golden Prolific, 8 yrs..	88	13
2. American Beauty, 8 yrs..	91	16	8. Bavarian, 8 yrs..	87	22
3. Danish Island, 5 yrs..	90	6	9. Golden Tartarian, 6 yrs..	86	33
4. Mennonite, 7 yrs..	90	..	10. Improved American, 5 yrs.... ..	86	32
5. Banner, 8 yrs..	88	29	11. Holstein Prolific, 8 yrs..	86	7
6. White Giant, 5 yrs..	88	24	12. Golden Giant, 8 yrs..	84	26

An average crop for the twelve varieties of 88 bushels 18 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Abundance, 8 yrs..	97	..	7. American Beauty, 8 yrs..	94	15
2. Improved American, 7 yrs., ...	96	13	8. Wide Awake, 8 yrs..	94	13
3. Danish Island, 5 yrs..	96	10	9. Columbus, 8 yrs..	94	10
4. Thousand Dollar, 5 yrs..	95	22	10 Golden Beauty, 8 yrs..	92	19
5. Holstein Prolific, 8 yrs..	95	19	11. Black Beauty, 5 yrs..	92	8
6. Banner, 8 yrs..	94	30	12. Buckbee's Illinois, 6 yrs..	90	31

An average crop for the twelve varieties of 94 bushels 18 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Black Beauty, 6 yrs..	73	32	7. Banner, 9 yrs..	65	30
2. Danish Island, 6 yrs..	73	23	8. White Giant, 6 yrs..	65	20
3 Golden Tartarian, 7 yrs..	72	5	9. Lincoln, 9 yrs..	64	33
4. Golden Giant, 7 yrs..	68	26	10. Mennonite, 8 yrs..	63	17
5. Salines, 5 yrs..	68	14	11. Buckbee's Illinois, 8 yrs..	63	8
6. New Zealand, 5 yrs..	67	9	12. Bavarian, 9 yrs..	62	27

An average crop for the twelve varieties of 67 bushels 17 lbs. per acre.

TEST OF VARIETIES OF BARLEY FOR A SERIES OF YEARS.

TWO-ROWED BARLEY.

The six varieties of two-rowed barley which have produced the largest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the bushel of barley is 48 lbs.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. French Chevalier, 9 yrs..	47	8	4. Danish Chevalier, 9 yrs..	45	17
2. Dunham, 6 yrs..	45	47	5. Clifford, 5 yrs..	44	44
3. Canadian Thorpe, 9 yrs..	45	17	6. Beaver, 9 yrs..	44	43

An average crop for the six varieties of 45 bushels 29 lbs per acre.

The six varieties of two-rowed barley which have averaged the heaviest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Canadian Thorpe, 9 yrs..	46	36	4. Danish Chevalier, 9 yrs..	45	23
2. French Chevalier, 9 yrs..	45	45	5 Clifford, 5 yrs..	43	46
3. Beaver, 9 yrs..	45	44	6. Dunham, 6 yrs..	43	33

An average crop for the six varieties of 45 bushels 14 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Danish Chevalier, 9 yrs..	46	26	4. Newton, 9 yrs..	44	34
2. Beaver, 9 yrs..	46	21	5. Canadian Thorpe, 9 yrs..	43	47
3. French Chevalier, 9 yrs..	45	22	6. Harvey, 5 yrs..	43	15

An average crop for the six varieties of 45 bushels 4 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Dunham, 4 yrs..	52	7	4. Sidney, 7 yrs...	44	37
2. Logan, 4 yrs..	48	41	5. French Chevalier, 7 yrs..	43	40
3. Harvey, 4 yrs..	45	..	6. Newton, 7 yrs..	41	15

An average crop for the six varieties of 45 bushels 47 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. French Chevalier, 9 yrs..	59	12	4. Sidney, 7 yrs..	55	40
2. Danish Chevalier, 9 yrs..	58	33	5. Jarvis, 5 yrs..	55	25
3. Canadian Thorpe, 9 yrs..	56	1	6. Clifford, 5 yrs..	54	..

An average crop for the six varieties of 56 bushels 13 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Dunham, 6 yrs..	45	25	4. Canadian Thorpe, 9 yrs..	42	32
2 Harvey, 5 yrs..	45	10	5. Beaver, 9 yrs..	41	36
3. Jarvis, 5 yrs..	43	28	6. French Chevalier, 9 yrs..	41	15

An average crop for the six varieties of 43 bushels 16 lbs. per acre.

SIX-ROWED BARLEY.

The six varieties of six-rowed barley which have produced the largest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury, 9 yrs..	52	45	4. Yale, 5 yrs..	50	38
2. Claude, 5 yrs..	51	5	5. Odessa, 9 yrs..	50	18
3. Mansfield, 5 yrs..	51	3	6 Brome, 5 yrs..	49	8

An average crop for the six varieties of 50 bushels 43 lbs. per acre.

The six varieties of six-rowed barley which have averaged the heaviest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Odessa, 9 yrs..	53	29	4. Brome, 5 yrs..	49	8
2. Mensury, 9 yrs..	52	9	5. Stella, 9 yrs..	48	32
3. Royal, 8 yrs..	49	8	6. Trooper, 9 yrs..	48	5

An average crop for the six varieties of 50 bushels 7 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mensury, 9 yrs..	53	6	4. Garfield, 5 yrs..	50	24
2. Yale, 5 yrs..	52	8	5. Oderbruch, 9 yrs..	48	34
3. Albert, 5 yrs..	51	32	6. Odessa, 9 yrs..	48	..

An average crop for the six varieties of 50 bushels 33 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Mansfield, 4 yrs	59	40	4. Argyle, 4 yrs	56	22
2. Yale, 4 yrs	56	39	5. Nugent, 7 yrs	53	20
3. Mensury, 7 yrs	56	26	6. Common, 7 yrs	53	2

An average crop for the six varieties of 56 bushels per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Claude, 4 yrs	66	47	4. Rennie's Improved, 8 yrs	58	20
2. Odessa, 8 yrs	63	4	5. Trooper, 8 yrs	57	46
3. Mensury, 8 yrs	59	12	6. Mansfield, 5 yrs	57	30

An average crop for the six varieties of 60 bushels 26 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Claude, 5 yrs	47	..	4. Brome, 5 yrs	45	28
2. Albert, 5 yrs	46	30	5. Mansfield, 6 yrs	45	27
3. Yale, 5 yrs	45	40	6. Argyle, 6 yrs	44	43

An average crop for the six varieties of 45 bushels 44 lbs. per acre.

TEST OF VARIETIES OF SPRING WHEAT FOR A SERIES OF YEARS.

The twelve varieties of spring wheat which have produced the largest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the bushel of wheat is 60 lbs.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 5 yrs..	39	34	7. Wellman's Fife, 9 yrs..	33	39
2. Clyde, 5 yrs..	35	9	8. Rio Grande, 9 yrs..	33	29
3. Laurel, 5 yrs..	34	58	9. White Fife, 9 yrs..	33	15
4. Preston, 9 yrs..	34	44	10. Huron, 9 yrs..	33	11
5. Goose, 9 yrs..	34	3	11. Red Fife, 9 yrs..	33	7
6. Monarch, 8 yrs..	33	47	12. Weldon, 5 yrs..	33	2

An average crop for the twelve varieties of 34 bushels 20 lbs. per acre.

The twelve varieties of spring wheat which have averaged the largest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 5 yrs..	30	58	7. Hungarian, 8 yrs..	27	34
2. Preston, 9 yrs..	30	17	8. Pringle's Champlain, 9 yrs.. ..	27	17
3. Laurel, 5 yrs..	28	57	9. Plumper, 6 yrs..	27	12
4. Clyde, 5 yrs..	28	26	10. Rio Grande, 9 yrs..	26	40
5. Huron, 9 yrs..	28	3	11. Monarch, 9 yrs..	26	29
6. Wellman's Fife, 9 yrs..	27	46	12. Colorado, 9 yrs..	26	28

An average crop for the twelve varieties of 28 bushels 1 lb. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Norval, 5 yrs..	39	52	7. Wellman's Fife, 9 yrs..	35	56
2. Laurel, 5 yrs..	39	44	8. Early Riga, 5 yrs..	35	52
3. Roumanian, 5 yrs..	39	4	9. Monarch, 8 yrs..	35	30
4. Clyde, 5 yrs..	38	56	10. White Connell, 9 yrs	35	22
5. Byron, 5 yrs..	37	11	11. Rio Grande, 9 yrs..	35	5
6. Red Swedish, 5 yrs..	35	59	12. Weldon, 5 yrs..	34	32

An average crop for the twelve varieties of 36 bushels 55 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 4 yrs..	45	15	7. Laurel, 4 yrs..	34	25
2. Goose, 8 yrs..	41	58	8. White Russian, 8 yrs..	33	59
3. White Fife, 8 yrs..	36	36	9. White Connell, 8 yrs....	33	47
4. Crown, 8 yrs..	35	30	10. Rio Grande, 8 yrs..	33	24
5. Monarch, 8 yrs..	35	17	11. Clyde, 4 yrs..	33	20
6. Red Fife, 8 yrs..	34	44	12. Wellman's Fife, 8 yrs..	33	6

An average crop for the twelve varieties of 35 bushels 57 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 4 yrs..	44	55	7. Stanley, 8 yrs..	41	41
2. Preston, 8 yrs..	43	31	8. Red Fife, 8 yrs..	41	38
3. Huron, 8 yrs..	43	16	9. Wellman's Fife, 8 yrs..	41	31
4. Weldon, 4 yrs..	42	40	10. Pringle's Champlain, 8 yrs.. ..	41	25
5. Red Fern, 8 yrs..	42	20	11. Hungarian, 7 yrs..	40	45
6. Percy, 8 yrs..	41	50	12. Rio Grande, 8 yrs..	40	41

An average crop for the twelve varieties of 42 bushels 11 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Roumanian, 5 yrs..	37	38	7. Plumper, 6 yrs..	34	32
2. Red Swedish, 5 yrs..	36	15	8. Fraser, 5 yrs..	34	29
3. Clyde, 5 yrs..	36	2	9. Crawford, 5 yrs..	34	18
4. Blair, 6 yrs..	35	38	10. Colorado, 7 yrs..	33	54
5. Early Riga, 5 yrs..	35	19	11. White Russian, 7 yrs..	33	34
6. Laurel, 5 yrs..	34	50	12. Preston, 9 yrs..	32	49

An average crop for the twelve varieties of 34 bushels 56 lbs. per acre.

TEST OF VARIETIES OF PEASE FOR A SERIES OF YEARS.

The twelve varieties of pease which have produced the largest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the bushel of peas is 60 lbs.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Crown, 8 yrs..	37	23	7. Carleton, 7 yrs..	35	22
2. Pride, 8 yrs..	36	41	8. Picton, 6 yrs..	35	10
3. English Grey, 5 yrs..	36	37	9. King, 7 yrs..	35	2
4. Early Britain, 7 yrs..	36	35	10. Arthur, 8 yrs..	34	59
5. German White, 6 yrs..	35	30	11. Paragon, 8 yrs..	34	50
6. Pearl, 5 yrs..	35	25	12. Agnes, 7 yrs..	34	42

An average crop for the twelve varieties of 35 bushels 41 lbs. per acre.

The twelve varieties of pease which have averaged the largest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Arthur, 8 yrs..	36	37	7. Crown, 8 yrs..	33	15
2. Paragon, 8 yrs..	35	29	8. English Grey, 4 yrs..	33	3
3. Kent, 7 yrs..	34	53	9. Mackay, 8 yrs..	32	37
4. Duke, 7 yrs..	33	49	10. Macoun, 7 yrs..	32	25
5. Prussian Blue, 9 yrs..	33	29	11. Pearl, 5 yrs..	32	22
6. Golden Vine, 7 yrs..	33	24	12. Mummy, 8 yrs..	32	17

An average crop for the twelve varieties of 33 bushels 38 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Crown, 8 yrs..	38	25	7. Nelson, 6 yrs..	31	20
2. Pride, 7 yrs..	34	9	8. New Potter, 8 yrs..	31	12
3. Agnes, 7 yrs..	32	14	9. Blk-eyed Marrowfat, 8 yrs..	30	44
4. Archer, 6 yrs..	31	57	10. English Grey, 5 yrs..	30	39
5. Centennial, 8 yrs..	31	46	11. Chancellor, 6 yrs..	30	8
6. Early Britain, 6 yrs..	31	26	12. Carleton, 7 yrs..	29	27

An average crop for the twelve varieties of 31 bushels 57 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Pride, 8 yrs..	46	..	7. King, 6 yrs..	43	13
2. Mummy, 8 yrs..	44	45	8. Trilby, 7 yrs..	43	13
3 German White, 5 yrs..	44	6	9. Pearl, 4 yrs..	42	32
4. White Wonder, 6 yrs..	43	28	10. Alma, 6 yrs..	42	27
5. Crown, 7 yrs..	43	16	11. Victoria, 6 yrs..	42	6
6. Carleton, 7 yrs..	43	14	12. Archer, 6 yrs..	42	..

An average crop for the twelve varieties of 43 bushels 22 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Paragon, 7 yrs..	44	56	7. Picton, 5 yrs..	40	57
2. Gregory, 6 yrs..	43	38	8. Pride, 7 yrs..	40	19
3. English Grey,, 4 yrs..	42	7	9. German White, 5 yrs..	40	18
4. Crown, 7 yrs..	42	4	10. Bruce, 4 yrs..	40	12
5. Early Britain, 6 yrs..	41	45	11. Wisconsin Blue, 4 yrs..	40	8
6. Carleton, 7 yrs..	41	31	12. Macoun, 7 yrs..	40	3

An average crop for the twelve varieties of 41 bushels 30 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. German White, 6 yrs..	38	35	7. English Grey, 5 yrs..	37	34
2. White Wonder, 7 yrs..	38	28	8. King, 6 yrs..	37	23
3 Bruce, 5 yrs..	38	14	9. Lanark, 6 yrs..	37	15
4. Pearl, 5 yrs..	38	12	10. Picton, 6 yrs..	36	57
5. Fergus, 5 yrs..	37	37	11. Gregory, 6 yrs..	36	55
6. Early Britain, 7 yrs..	37	35	12. Arthur, 8 yrs..	35	54

An average crop for the twelve varieties of 37 bushels 33 lbs. per acre.

TEST OF VARIETIES OF INDIAN CORN FOR A SERIES OF YEARS.

The six varieties of Indian corn which have produced the heaviest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1 Early Mastodon, 6 yrs..	20	753	4. Salzer's All Gold, 4 yrs..	19	836
2. Superior Fodder, 4 yrs..	19	1,561	5. Red Cob Ensilage, 9 yrs...	19	103
3. Thoroughbred White Flint..	19	934	6. Early Butler, 7 yrs..	18	1,018

An average crop for the six varieties cut green for ensilage of 19 tons 867 lbs. per acre.

The six varieties of Indian corn which have averaged the heaviest crops at the several experimental farms for a series of years are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Mastodon, 6 yrs..	23	1,309	4. Red Cob Ensilage, 9 yrs..	23	600
2. Giant Prolific Ensilage, 9 yrs.. ..	23	1,163	5. Selected Leaming, 8 yrs..	22	1,010
3. Thoroughbred White Flint, 9 yrs.	23	1,012	6. Superior Fodder, 4 yrs..	22	640

An average crop for the six varieties cut green for ensilage of 23 tons 289 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Early Mastodon, 6 yrs..	20	1,925	4. Thoroughbred White Flint, 9 yrs.	18	616
2. Superior Fodder, 4 yrs..	20	837	6. Red Cob Ensilage, 9 yrs..	17	453
3. Salzer's All Gold, 4 yrs..	18	950	5. Mammoth Cuban, 6 yrs..	17	1,603

An average crop for the six varieties cut green for ensilage, of 18 tons 1,731 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Thoroughbred White Flint, 9 yrs.	21	1,179	4. Champion White Pearl, 9 yrs....	19	541
2. Early Mastodon, 6 yrs..	20	165	5. Longfellow, 9 yrs..	18	1,772
3. Angel of Midnight, 9 yrs..	19	635	6. Superior Fodder, 4 yrs..	18	1,323

An average crop for the six varieties cut green for ensilage, of 19 tons 1,267 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Salzer's All Gold, 4 yrs..	17	1,493	4. Early Butler, 7 yrs..	13	1,694
2. Superior Fodder, 4 yrs..	14	1,876	5. Angel of Midnight, 9 yrs..	13	1,260
3. Early Mastodon, 6 yrs..	14	74	6. Giant Prolific Ensilage, 9 yrs.....13		837

An average crop for the six varieties cut green for ensilage of 14 tons 1,206 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Cob Ensilage..	24	966	4. Superior Fodder..	22	1,127
2. Early Butler..	23	1,163	5. Pride of the North..	21	1,958
3. Early Mastodon..	22	292	6. Mammoth Cuban..	21	1,483

An average crop for the six varieties cut green for ensilage of 22 tons 1,831 lbs. per acre.

TEST OF VARIETIES OF TURNIPS FOR A SERIES OF YEARS.

The six varieties of turnips which have produced the heaviest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Perfection Swede, 8 yrs..	32	263	4. Selected Purple Top, 8 yrs..	31	486
2. Imperial Swede, 5 yrs..	32	107	5. Magnum Bonum, 4 yrs..	31	75
3. Halewood's Bronze Top, 7 yrs..	31	558	6. Hall's Westbury, 7 yrs..	31	72

An average crop for the six varieties of 31 tons 927 lbs. per acre.

The six varieties of turnips which have averaged the heaviest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Kangaroo, 4 yrs..	36	1,590	4. Drummond Purple Top, 6 yrs....	35	1,445
2. Magnum Bonum, 4 yrs..	36	1,056	5. Selected Purple Top, 8 yrs.. ..	35	1,143
3. Elephant's Master, 4 yrs..	36	95	6. Carter's Elephant, 9 yrs..	35	583

An average crop for the six varieties of 34 tons 486 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Kangaroo, 4 yrs..	41	1,407	4. Magnum Bonum, 4 yrs..	40	107
2. Elephant's Master, 4 yrs..	41	789	5. Perfection Swede, 8 yrs..	38	411
3. Imperial Swede, 5 yrs..	40	573	6. Halewood's Bronze Top, 7 yrs..	38	65

An average crop for the six varieties of 39 tons 1,892 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Hartley's Bronze, 8 yrs..	26	721	4. Skirvings, 9 yrs..	24	1,901
2. Magnum Bonum, 4 yrs..	25	94	5. Selected Purple Top, 8 yrs.. ..	24	1,573
3. Perfection Swede, 8 yrs..	25	11	6. Hall's Westbury, 7 yrs..	24	1,472

An average crop for the six varieties of 25 tons 295 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Perfection Swede, 8 yrs..	23	57	4. Halewood's Bronze Top, 7 yrs..	22	556
2. Imperial Swede, 5 yrs..	22	1,370	6. Hall's Westbury, 7 yrs..	21	1,916
3. Hartley's Bronze, 8 yrs..	22	1,145	6. Drummond Purple Top, 6 yrs....	21	1,211

An average crop for the six varieties of 22 tons 709 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Bangholm Selected, 7 yrs..	41	525	4. Hall's Westbury, 7 yrs..	39	512
2. Perfection Swede, 8 yrs..	40	653	5. Selected Purple Top, 8 yrs.. ..	39	457
3. Halewood's Bronze Top, 7 yrs....	39	1,052	6. Imperial Swede, 5 yrs..	38	1,704

An average crop for the six varieties of 39 tons 1,484 lbs. per acre.

TEST OF VARIETIES OF MANGELS FOR A SERIES OF YEARS.

The six varieties of mangels which have produced the heaviest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant Yellow Intermediate, 8 yrs.	32	454	4. Mammoth Long Red, 8 yrs.. ..	31	1,330
2. Yellow Intermediate, 8 yrs.. ..	32	238	5. Mam. Yellow Intermediate, 6 yrs	31	777
3. Lion Yellow Intermediate, 5 yrs..	31	1,972	6. Gate Post, 8 yrs..	31	314

An average crop for the six varieties of 31 tons 1,514 lbs. per acre.

The six varieties of mangels which have averaged the heaviest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Prize Winner Yellow Globe, 4 yrs.	40	1,716	4. Half Long Sugar White, 4 yrs....	39	86
2. Mammoth Long Red, 8 yrs..	39	1,551	5. Lion Yellow Intermediate, 5 yrs..	38	407
3. Gate Post, 8 yrs..	39	422	6. Half Long Sugar Rosy, 4 yrs...	37	781

An average crop for the six varieties of 39 tons 160 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Prize Winner Yellow Globe, 4 yrs.	40	1,469	4. Giant Yellow Intermediate, 8 yrs.	36	1,965
2. Lion Yellow Intermediate, 5 yrs...	40	452	5. Half Long Sugar White, 4 yrs....	35	1,857
3. Mam. Yellow Intermediate, 6 yrs.	38	597	6 Half Long Sugar Rosy, 4 yrs.. ..	35	1,775

An average crop for the six varieties of 38 tons 19 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Selected Mamm. Long Red, 7 yrs.	32	1,899	4. Prize Mamm. Long Red, 8 yrs....	30	1,215
2. Mamm. Long Red, 8 yrs..	31	823	5. Giant Yellow Intermediate, 8 yrs.	30	893
3. Yellow Intermediate, 8 yrs..	31	669	6. Gate Post, 8 yrs..	30	17

An average crop for the six varieties of 31 tons 253 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Prize Winner Yellow Globe, 4 yrs	23	399	4. Selected Mamm. Long Red, 7 yrs.	22	1,003
2. Lion Yellow Intermediate, 5 yrs.	23	331	5 Gate Post, 8 yrs..	22	309
3. Yellow Intermediate, 8 yrs.. ..	22	1,219	6. Giant Yellow Intermediate, 8 yrs.	22	51

An average crop for the six varieties of 22 tons 1,219 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant Yellow Intermediate, 8 yrs..	35	218	4. Mammoth Long Red, 8 yrs..	34	703
2. Lion Yellow Intermediate, 5 yrs..	34	1,940	5. Selected Mamm. Long Red, 7 yrs.	33	1,476
3. Yellow Intermediate,8 yrs..	34	1,800	6. Mamm. Yellow Intermediae, 5 yrs.	33	587

An average crop for the six varieties of 34 tons 787 lbs. per acre.

TEST OF VARIETIES OF CARROTS FOR A SERIES OF YEARS.

The six varieties of carrots which have produced the heaviest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate, 5 yrs..	23	1,257	4. Mamm. White Intermediate, 8 yrs	21	1,177
2. Giant White Vosges, 8 yrs.. ..	22	762	5. Improved Short White, 8 yrs....	21	1,135
3. Ontario Champion, 6 yrs..	21	1,659	6. Half Long White, 8 yrs..	21	517

An average crop for the six varieties of 22 tons 84 lbs. per acre.

The six varieties of carrots which have averaged the heaviest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate, 5 yrs..	35	653	4. Improved Short White, 8 yrs....	29	1,207
2. Giant White Vosges, 8 yrs.. ..	30	1,446	5. Half Long White, 8 yrs..	29	230
3. Mamm. White Intermediate, 8 yrs	30	1,442	6. Ontario Champion, 6 yrs..	28	1,420

An average crop for the six varieties of 30 tons 1,400 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate, 5 yrs..	24	11	4. Giant White Vosges, 8 yrs..	22	1,058
2. Ontario Champion, 6 yrs..	22	1,655	5. Half Long White, 8 yrs..	21	851
3. Mamm. White Intermediate, 8 yrs	22	1,537	6. Long Yellow Stump Rooted, 4 yrs	20	1,291

An average crop for the six varieties of 22 tons 742 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate, 5 yrs..	15	1,768	4. Giant White Vosges, 8 yrs	13	1,357
2. Ontario Champion, 6 yrs..	14	1,920	5. Half Long White, 8 yrs..	13	1,357
3. Long Yellow Stump-rooted, 4 yrs	13	1,835	6. Mamm. White Intermediate, 8 yrs.	13	1,211

An average crop for the six varieties of 14 tons 750 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. New White Intermediate, 4 yrs..	14	68	4. Half Long White, 8 yrs..	11	1,405
2. Ontario Champion, 6 yrs..	12	1,460	5. Improved Short White, 7 yrs....	11	1,343
3. Long Yellow Stump-rooted, 4 yrs	12	931	6. Giant White Vosges, 7 yrs.. ..	11	188

An average crop for the six varieties of 12 tons 566 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Giant White Vosges, 8 yrs..	33	1,259	4. Half Long White, 8 yrs..	30	240
2. Improved Short White, 8 yrs....	33	834	5. Ontario Champion, 6 yrs..	29	1,840
3. Mamm. White Intermediate, 8 yrs	30	849	6. White Belgian, 8 yrs..	29	668

An average crop for the six varieties of 31 tons 282 lbs. per acre.

TEST OF VARIETIES OF SUGAR BEETS FOR A SERIES OF YEARS.

The four varieties of sugar beets which have produced the heaviest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the ton is 2,000 lbs.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top, 6 yrs..	26	556	3. Red Top Sugar, 7 yrs..	24	19
2. Danish Improved, 7 yrs..	24	84	4. Improved Imperial, 7 yrs..	23	1,068

An average crop for the four varieties of 24 tons 932 lbs. per acre.

The four varieties of sugar beets which have averaged the heaviest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Improved, 7 yrs..	29	795	3. Danish Red Top, 6 yrs..	28	1,860
2. Improved Imperial, 7 yrs..	29	10	4. Red Top Sugar, 7 yrs..	27	1,935

An average crop for the four varieties of 28 tons 1,650 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Red Top Sugar, 7 yrs..	28	387	3. Improved Imperial, 7 yrs..	26	1,694
2. Danish Red Top, 6 yrs..	27	1,919	4. Danish Improved, 7 yrs..	26	55

An average crop for the four varieties of 27 tons 514 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top, 6 yrs..	27	901	3. Red Top Sugar, 7 yrs..	23	639
2. Danish Improved, 7 yrs..	24	699	4. Wanzleben, 7 yrs..	22	1,021

An average crop for the four varieties of 19 tons 815 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top, 6 yrs..	18	999	3. Improved Imperial, 7 yrs..	16	727
2. Red Top Sugar, 7 yrs..	16	1,827	4. Danish Improved, 7 yrs..	15	1,463

An average crop for the four varieties of 11 tons 503 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Tons.	Lbs.		Per acre. Tons.	Lbs.
1. Danish Red Top, 5 yrs..	28	1,103	3. Danish Improved, 6 yrs..	24	1,402
2. Improved Imperial, 6 yrs..	25	162	4. Red Top Sugar, 6 yrs..	23	1,305

An average crop for the four varieties of 16 tons 1,995 lbs. per acre.

TEST OF VARIETIES OF POTATOES FOR A SERIES OF YEARS.

The twelve varieties of potatoes which have produced the largest crops for a series of years, taking the average of the results obtained on all the experimental farms, are the following :—

The length of time they have been under trial is stated in each case.

In Canada the bushel of potatoes is 60 lbs.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Uncle Sam, 4 yrs..	395	20	7. Late Puritan, 9 yrs..	374	48
2. Seedling No 7, 7 yrs..	393	33	8. Country Gentleman, 5 yrs..	373	59
3. Irish Daisy, 8 yrs..	386	25	9. Carman No 1, 9 yrs..	373	47
4. American Wonder, 9 yrs..	381	42	10. Burnaby Seedling, 8 yrs..	371	23
5. Rose No. 9, 7 yrs..	378	22	11. Penn Manor, 5 yrs..	364	58
6. American Giant, 8 yrs..	377	6	12. State of Maine, 9 yrs..	363	13

An average crop for the twelve varieties of 377 bushels 53 lbs. per acre.

The twelve varieties of potatoes which have averaged the largest crops at the several experimental farms for a series of years, are the following :—

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Late Puritan, 9 yrs..	436	32	7. Carman No. 1, 9 yrs..	398	4
2. Holborn Abundance, 9 yrs..	408	10	8. Burnaby Seedling, 8 yrs..	394	44
3. American Wonder, 9 yrs..	401	28	9. Country Gentleman, 5 yrs.	392	2
4. Uncle Sam, 4 yrs..	401	8	10. Rose No. 9, 7 yrs..	390	39
5. Dreer's Standard, 9 yrs..	398	50	11. Money Maker, 9 yrs..	386	36
6. Penn. Manor, 5 yrs..	392	38	12. State of Maine, 9 yrs..	379	48

An average crop for the twelve varieties of 399 bushels 13 lbs. per acre.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES, NAPPAN, N.S.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Irish Daisy, 8 yrs..	420	35	7. Troy Seedling, 9 yrs..	383	42
2. Holborn Abundance, 9 yrs..	408	18	8. American Giant, 8 yrs..	375	45
3. Seedling, No. 7, 7 yrs..	406	..	9. Penn. Manor, 5 yrs..	374	..
4. Vanier, 8 yrs..	400	15	10. Burnaby Seedling, 8 yrs..	371	45
5. Irish Cobbler, 7 yrs..	388	52	11. Vick's Extra Eearly, 8 yrs.. ..	368	47
6. Clay Rose, 9 yrs..	387	41	12. Everett, 9 yrs..	366	40

An average crop for the twelve varieties of 387 bushels 42 lbs. per acre.

EXPERIMENTAL FARM FOR MANITOBA, BRANDON, MAN.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Delaware, 8 yrs.	422	13	7. Empire State, 8 yrs.	385	22
2. Seedling No. 7, 7 yrs.	417	29	8. Burnaby Seedling, 8 yrs.	383	32
3. Maule's Thoroughbred, 6 yrs.	412	30	9. Uncle Sam, 4 yrs.	381	57
4. American Wonder, 9 yrs.	404	54	10. Reeve's Rose, 7 yrs.	380	17
5. Irish Daisy, 8 yrs.	400	35	11. I. X. L., 9 yrs.	378	53
6. State of Maine, 9 yrs.	399	8	12. Late Puritan, 9 yrs.	377	52

An average crop for the twelve varieties of 395 bushels 23 lbs. per acre.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES, INDIAN HEAD, N.W.T.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. American Giant, 8 yrs.	474	28	7. Carman No. 1, 9 yrs.	427	32
2. Uncle Sam, 4 yrs.	467	7	8. Lee's Favourite, 8 yrs.	420	47
3. Country Gentleman, 5 yrs.	457	40	9. Rochester Rose, 8 yrs.	419	37
4. American Wonder, 9 yrs.	446	30	10 General Gordon, 7 yrs.	415	45
5. Carman No. 3, 7 yrs.	438	27	11. Empire State, 9 yrs.	403	40
6. Bovee, 6 yrs.	429	6	12. Penn. Manor, 5 yrs.	403	32

An average crop for the twelve varieties of 433 bushels 41 lbs. per acre.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA, AGASSIZ, B.C.

	Per acre. Bush.	Lbs.		Per acre. Bush.	Lbs.
1. Uncle Sam, 4 yrs.	419	14	7. Brown's Rot Proof, 7 yrs.	364	14
2. Rose No. 9, 7 yrs.	406	3	8. Clay Rose, 9 yrs.	363	12
3. Seedling, No. 7, 7 yrs.	383	5	9. Cambridge Russet, 6 yrs.	358	1
4. Reeve's Rose, 8 yrs.	368	17	10. Vick's Extra Early, 7 yrs.	355	45
5. Bovee, 6 yrs.	366	27	11. Maule's Thoroughbred, 6 yrs.	353	38
6. Irish Daisy, 8 yrs.	366	4	12. Vanier, 9 yrs.	347	30

An average crop for the twelve varieties of 371 bushels 2 lbs. per acre.

CONCLUSIONS.

The evidence afforded by the results obtained from the comparative trial plots as given in this bulletin, shows that there are great differences in the relative productiveness of varieties even when grown side by side under similar conditions. It also shows, in that part of the bulletin devoted to the average of crops for a series of years, that this tendency to productiveness is in many instances a fixed quality manifested in the different climates of the Dominion, thus bringing these varieties near the top of the list from year to year. Among those sorts which have a remarkable record for persistent productiveness are the Banner oats, which have given for the past nine years (taking the average of the results obtained at all the experimental farms) 78 bushels 25 lbs. per acre ; the Mensury barley, which has averaged for the same period 52 bushels 45 lbs., and the Preston wheat, which has given for nine years an average of 34 bushels 44 lbs. per acre.

Such facts point to the importance to farmers of choosing for seed those sorts which give the heaviest crops, so that farming in Canada may thus be made more profitable.

In this bulletin all the varieties which have been under trial for four or more years, are admitted into the comparative list with those which have been under trial for longer periods. As a result of this arrangement, some of the more promising of the recently introduced sorts have found their way into the lists of the best 12 or the best 6 varieties for weight of crop. It is, however, noteworthy that in most instances the larger part of these lists consists of varieties which have been under trial for 8 or 9 years, and which have maintained their prominence as productive sorts through the whole of that period.

During the past year the number of varieties under test has been reduced by discontinuing those which, after some years' trial, have not come up to a high standard of productiveness, retaining only the newer sorts and the best of the older ones in each case. This reduction in number permits of a more ready selection of varieties and brings out with greater prominence those of the highest excellence.

Provision has been made in connection with the distribution of samples for the improvement of seed (which takes place annually at the experimental farms) to have available considerable quantities of the very best and most productive sorts of cereals; so that any farmer in Canada who applies in good season, before March 1, may obtain a sample. These are sent out free by mail in cotton bags. The sample bags of oats contain 4 lbs., and those of wheat and barley, 5 lbs : sufficient in each case to sow one-twentieth of an acre. Instructions accompany each sample. In many instances the 4 lbs. of oats, when carefully handled, have produced from 150 to 200 bushels by the end of the second year, showing that with attention and care any farmer may soon provide himself, under this liberal arrangement, with the best and most productive

strains of seed in sufficient quantities for a large area, at no cost to himself beyond that of his own labour.

That Canadian farmers readily avail themselves of these privileges, is seen from the fact that during the past six years 224,543 samples have been supplied to individual applicants : an annual average during this period of 37,424. The steady increase being made in the yearly average of crops in this country amounting in the aggregate to many millions of dollars, is no doubt due in large measure to the cultivation of improved and more productive varieties, brought about mainly by these annual distributions, by means of which more than 37,000 farmers have been led to join every year in these co-operative experiments with great profit to themselves and the country.

1 33
.E22

NOV 27 1950

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

EMMER AND SPELT

BY

Chas. E. Saunders, B.A., Ph.D.
Experimentalist

BULLETIN No. 45

JUNE, 1904

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE:

To the Honourable
The Minister of Agriculture.

SIR,—I have pleasure in submitting for your approval Bulletin No. 45 of the Experimental Farm series on Emmer and Spelt, which has been prepared under my direction by Dr. C. E. Saunders, Experimentalist.

In this bulletin descriptions of a number of varieties are given of emmer and spelt, and the results of many experiments submitted which have been conducted with these cereals at the experimental farms.

Much interest has been awakened of late among farmers in this country in the growing of emmer and spelt, and in the bulletin herewith presented, many facts are brought together regarding the proportion of hull to kernel and the relative usefulness and cropping power of emmer and spelt in comparison with other cereals.

To make the information more complete some analyses have been made by the Chemical Division of the kernels and hulls of emmer and spelt, which show the relative nutritive value of these materials.

I have the honour to be,
Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, June 28, 1904.

EMMER AND SPELT.

The classification of the different varieties of wheat, and of those cereals closely related to wheat, has been attempted in various ways by botanists; and opinions are divided as to whether emmer and spelt can fairly be classed as varieties of wheat or not. The classification perhaps most commonly accepted recognizes wheat as occurring under three distinct species : *Triticum Polonicum, T. monoccum* and *T. sativum* The last named species is divided into three sub-species as follows : *T. sativum spelta*=Spelt (Epeautre in French) *T. sativum dicoccum*=Emmer (Amidonnier in French) and *T. sativum tenax*=common wheat.

For the purposes of this bulletin it is unnecessary to discuss at length the question of classification, but we may conveniently use the divisions as given above, employing the term 'spelt' for those varieties of cereals included under the sub-species *T. sativum spelta* and the term 'emmer' (a German word for which there is no English equivalent) for those coming under *T. sativum dicoccum.* For the sake of simplicity it seems desirable to include under the term 'emmer' the species *T. monococcum,* which, however distinct from a botanical point of view, certainly bears a strong resemblance to some of the varieties of *T. sativum dicoccum.*

Although closely related to true wheat, both spelt and emmer are in a commercial sense quite distinct from it, and should be compared rather with oats and barley. While it is no doubt possible to make flour from emmer and spelt, it is extremely improbable that this will ever be done in America. Meanwhile, these grains are being used for the feeding of cattle, &c., and it is for such purposes that they deserve consideration.

GENERAL DESCRIPTION.

The most striking characteristic of spelt and emmer, which distinguishes them at once from all the true wheats, is the fact that the chaff adheres to the grain after it has passed through an ordinary threshing process. If the operation is very severe a proportion of the grain will be threshed out clean, but not enough to leave any doubt as to the identity of the sample. This peculiarity is due both to the tightness with which the chaff clings to the grain and to the unusual brittleness of the stem (or rachis). The grain itself is usually long, of rather large size and very hard, resembling the macaroni wheats (of which Goose is our commonest example in Canada), rather than the ordinary wheats. The straw of the emmers and spelts varies in character. In emmer it is usually rather short and thin, and sometimes is not sufficiently strong to prevent lodging of the grain. In spelt the straw is coarser.

DISTINCTIONS BETWEEN EMMER AND SPELT.

Various points of difference between emmer and spelt might be given, but it will be sufficient to mention two or three of the most striking. The heads of emmer are essentially short, compact and flat, the spikelets being set very close together; while the heads of spelt are long and open, the spikelets being set quite far apart. All the emmers are bearded, but some of the spelts are beardless. Spelt is generally of coarser type than emmer and the proportion of husk present in the threshed grain is usually larger.

WEIGHT PER BUSHEL.

The weight of a measured bushel of emmer or spelt depends largely on the variety and on the way in which it has been threshed ; loose kernels, if present, materially increase the weight. Roughly speaking, one may say that emmer generally weights from 30 to 38 lbs. and spelt from 22 to 30 lbs. per measured bushel.

SPECIAL POINTS OF MERIT.

Both emmer and spelt have been found, so far as tested at the experimental farms, to be as a rule comparatively free from rust. It is also generally believed that they withstand drought very well, and will thrive on soil which is too light to give a good crop of wheat. These most desirable characteristics certainly show that these cereals merit the attention of Canadian farmers in some sections of the country; but they do not, as is sometimes assumed, demonstrate the superiority of emmer and spelt to wheat, oats and barley.

PRINCIPAL VARIETIES OF EMMER AND SPELT.

Most of the varieties mentioned in this bulletin are practically unknown in Canada and do not possess recognized English names. It has been found necessary, therefore, to give suitable names to them. The descriptions and wood cuts will serve to identify the varieties in cases where any of them are already known under other names. The wood cuts are made direct from photographs and show the actual size of the heads, except that in some cases the awns are not represented in their full length. The tests which are being carried on at the Dominion Experimental Farms in regard to the relative productiveness of emmer and spelt do not yet permit the drawing of any definite conclusions; but it appears that Common Emmer (the variety generally grown) will hold its place as one of the best sorts.

Six varieties of emmer and five varieties of spelt are here described. The length of stem, length of head, &c., given in the descriptions refer to the grain as produced at Ottawa. The figures are to be taken as approximate only, and are useful rather in a relative than an absolute sense.

Common Emmer (Fig. 1).—This variety is also known as Ufa Emmer, and commonly but incorrectly called 'speltz' in America. This latter word is a misapplied corruption of the German word 'spelz.' The name White Emmer has also been used for this variety, but White Emmer and Common Emmer, as described in this bulletin, are distinct varieties. Kernels reddish in colour, pointed at both ends, rather large and very hard. (100 kernels weigh about 3 to 3½ grammes.)*

Gluten lacks elasticity.

Heads bearded, about 2 to 3 inches long.

Chaff smooth, pale yellowish, (that is "white" as the term is commonly used.)

Straw thin, but usually sufficiently strong for the weight of the heads. Straw (including heads) about 35 to 50 inches long.

Ripens about mid-season (as compared with wheats.)

The threshed grain usually contains about 78 per cent to 79 per cent of kernel, and 22 per cent to 21 per cent of husk. Loose kernels, if present, will of course materially alter these proportions.

White Emmer.—This variety resembles Common Emmer, but is distinguished from it by having a somewhat larger head and being later in ripening.

Kernels reddish, large, pointed, hard. (100 kernels weigh about 3 grammes).

Gluten only slightly elastic.

* 100 kernels of Red Fife commonly weigh about 3·1 grammes.

Fig. 1.—Common Emmer.

Fig. 2.—Single Emmer
(Triticum monococcum.)

Heads bearded, about 2½ to 3½ inches long.
Chaff very pale yellowish, smooth.
Straw thin, but stiff, about 38 to 48 inches long.
Ripens late (about a week later than Common Emmer).
This variety is sometimes considerably affected by rust.
The threshed grain usually contains about 76 per cent of kernel and 24 per cent of husk.

Long Emmer (Fig. 3).—This has perhaps the longest head of all the emmers, but it preserves the essential characteristics of this class of cereal, the head being distinctly flattened and the spikelets close together.

Kernels reddish, very large, pointed, very hard. (100 kernels weigh about 4 grammes).
Gluten very dark and strikingly deficient in elasticity.
Heads bearded, about 3½ to 4½ inches long.
Chaff yellowish, smooth.
Straw stiff, about 40 to 50 inches long.
Ripens very late, about two weeks later than Common Emmer.
The threshed grain usually contains about 74 per cent of kernel and 26 per cent of husk.

Red Emmer.—This variety resembles Long Emmer in many ways, but is easily distinguished by its reddish chaff.

Kernels red, large, pointed, hard. (100 kernels weigh about 3 to 3½ grammes.)
Gluten very deficient in elasticity.
Heads bearded, about 3 to 4½ inches long.
Chaff a rather dark reddish colour, smooth.
Straw stiff, about 40 to 50 inches long.
Ripens late, about a week later than Common Emmer.
The threshed grain usually contains about 75 to 78 per cent of kernel and 25 to 22 per cent of husk.

Thick Emmer (Fig. 4.)—This is readily distinguished by the fact that the tip of the head is thickened somewhat after the manner of the Club wheats.

Kernels reddish, large, pointed, very hard. (100 kernels weigh about 3½ or 4 grammes).
Gluten not of good quality, deficient in elasticity, but superior to some of the other emmers.
Heads bearded, about 2½ to 3½ inches long, thickened at the tip.
Chaff reddish, smooth.
Straw stiff, about 34 to 48 inches long.
Ripens approximately with Common Emmer.
The threshed grain usually contains about 73 per cent of kernel and 27 per cent of husk.

Single Emmer.—Triticum monococcum (Fig. 2).—This variety is characterised chiefly by the small size of the head and by having only one kernel in each spikelet.

Kernels red, small, flattened, rather soft. (100 kernels weigh about 2 to 2½ grammes.)
Gluten dark and remarkably poor.
Heads bearded, about 2¼ to 2¾ inches long, very much flattened and with the spikelets remarkably close together. Awns delicate.
Chaff yellowish, smooth.
Straw thin but stiff, about 38 to 45 inches long.
Ripens very late, too late to be popular for general cultivation.
The threshed grain usually contains about 73 per cent of kernel and 27 per cent of husk.

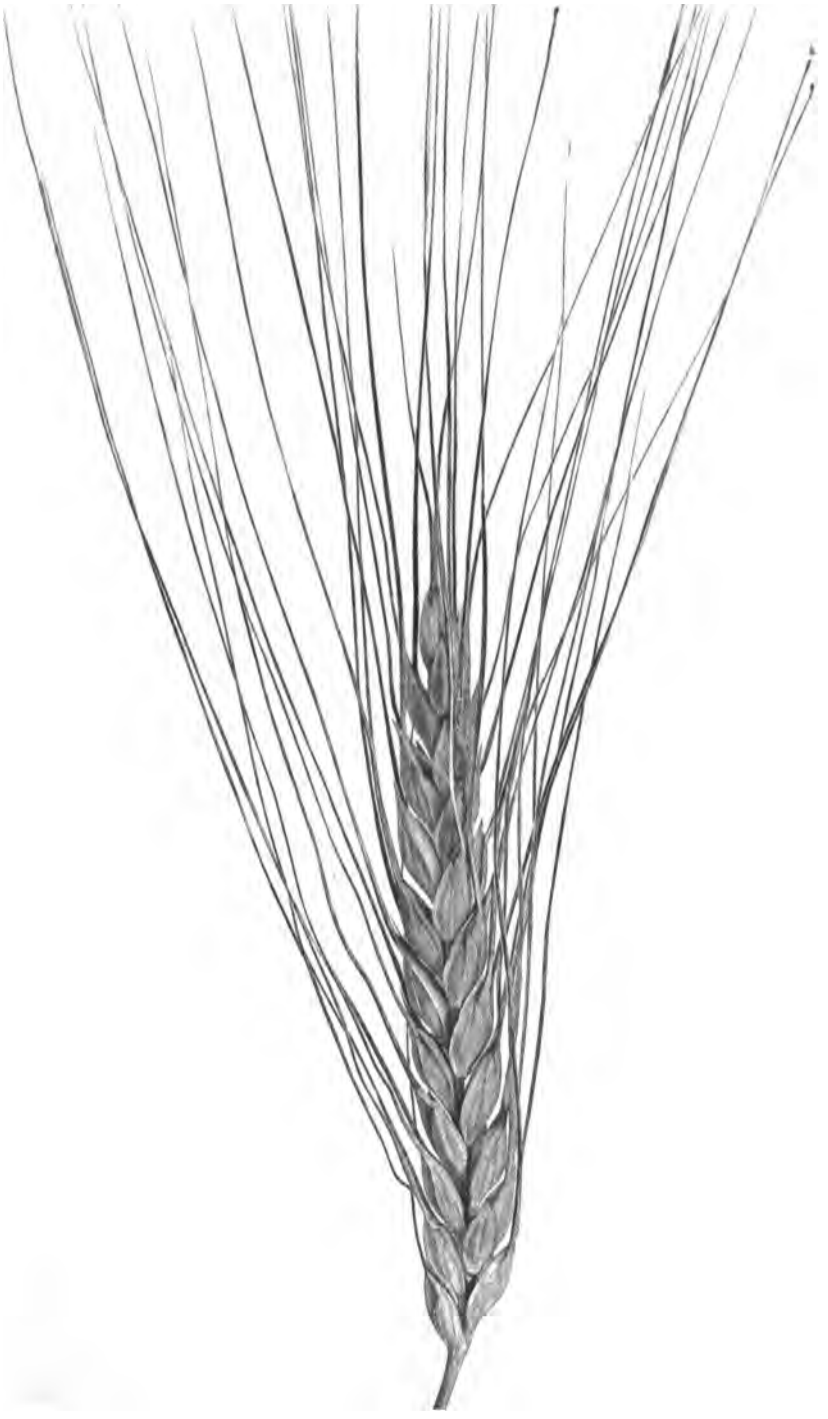


Fig. 3.—Long Emmer.

Fig. 4.—Thick Emmer.

Double Emmer.—This variety appears to be essentially the same in most respects as Single Emmer. It, however, often contains two kernels in a spikelet. It is not so late in ripening as Single Emmer.

White-bearded Spelt (Fig. 5.)—This possesses a long, coarse head with stiff awns, and spikelets set far apart.

Kernels reddish, rather large and moderately hard. (100 kernels weigh about 3½ grammes.)

Gluten of rather poor quality.

Heads bearded, about 4 to 6 inches long.

Chaff yellowish, smooth.

Straw stiff, 34 to 48 inches long.

Ripens about mid-season (as compared with ordinary wheats.)

The threshed grain usually contains about 72 or 73 per cent of kernel and 28 or 27 per cent of husk.

Black-bearded Spelt.—This closely resembles White-bearded Spelt, but the awns (and sometimes the chaff) are dark in colour. This dark colour is, however, not constant, varying in different seasons and climates from dull reddish to almost pure black.

Kernels reddish, rather large. (100 kernels weigh about 3 to 3½ grammes.)

Gluten of good quality.

Heads bearded, about 4½ to 6½ inches long.

Chaff and awns vary in colour from dull reddish to black ; chaff smooth.

Straw fairly stiff, about 38 to 48 inches long.

Ripens with White-bearded Spelt.

The threshed grain usually contains about 71 to 78 per cent of kernel and 29 to 22 per cent of husk.

White Spelt (Fig. 6.)—This is a beardless variety, otherwise resembling White-bearded Spelt in most respects.

Kernels reddish, rather long, not very hard. (100 kernels weigh about 3 to 3½ grammes.)

Gluten of very fair quality.

Heads beardless, about 4½ to 6½ inches long.

Chaff pale yellowish, smooth.

Straw stiff, about 45 to 50 inches long.

Ripens with White-bearded Spelt.

The threshed grain usually contains between 62 and 70 per cent of kernel and between 38 and 30 per cent of husk.

Smooth Spelt.—This is a beardless variety resembling White Spelt and scarcely to be distinguished from it except when the varieties are growing near together.

Kernels reddish, rather long and not very hard. (100 kernels weigh about 3 to 3½ grammes.)

Gluten of good quality.

Heads beardless, about 4½ to 6½ inches long.

Chaff pale yellowish, smooth.

Straw stiff, about 45 to 50 inches long.

Ripens somewhat later than White Spelt.

The threshed grain usually contains from 67 to 73 per cent of kernel and from 33 to 27 per cent of husk.

Red Spelt.—This variety resembles White Spelt in most respects, but is distinguished from it by the colour of the chaff.

Kernels reddish, large, rather long, not very hard. (100 kernels weigh about 3 to 3½ grammes.)

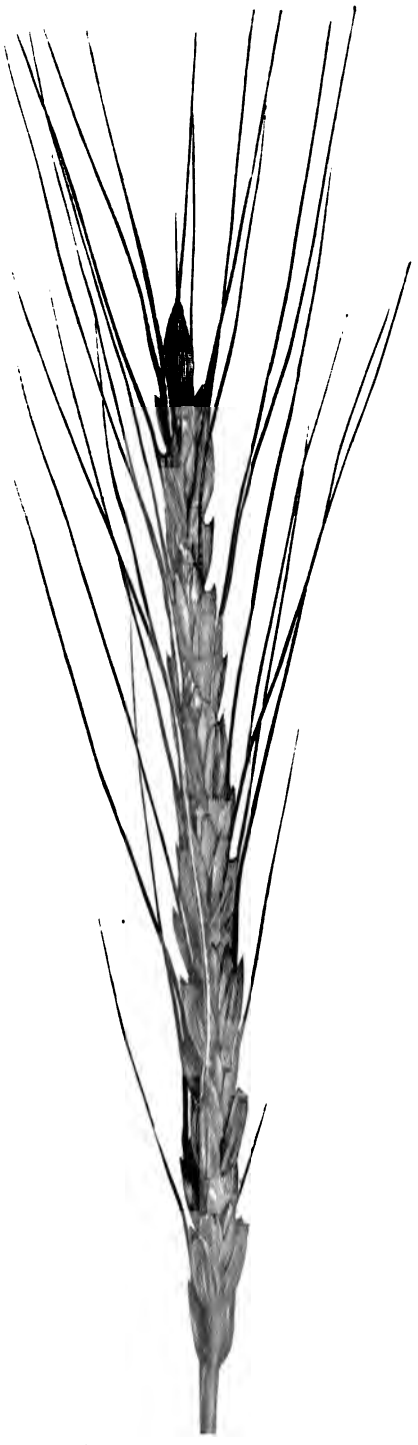


Fig. 5.—White Bearded Spelt.

Fig. 6.—White Spelt.

Gluten of good quality.
Heads beardless, about 3½ to 5½ inches long.
Chaff reddish, smooth.
Straw stiff, about 45 to 50 inches long.
Ripens somewhat later than White Spelt.
The threshed grain usually contains about 70 per cent of kernel and 30 per cent of husk.

NEW HYBRIDS OF EMMER.

A number of new hybrids have been produced by the writer of this bulletin during the last few years, by crossing different sorts of emmer with varieties of wheat. The results thus obtained are of considerable interest. Some of the new varieties produced by crossing Common Emmer with Colorado wheat are very strong and productive, but the work has not been carried on long enough to decide as to their precise value, and whether or not they are worthy of being introduced for general cultivation.

CULTIVATION OF COMMON EMMER.

Of all the varieties of emmer and spelt described, this is the only one which is known (to any extent) to the farmers of Canada. On this account and because of the marvellous claims made for this cereal by certain interested individuals it seems best to consider carefully the methods of cultivation, the uses and the value of Common Emmer.

Soil and Climate.—So far as the tests at the Experimental Farms have gone, it appears that emmer requires about the same methods of cultivation as other cereals, but that it will thrive on lighter soil and will withstand drought very well. Where the rainfall in July and August is plentiful, emmer does not, as a rule, give a very large crop. This most important fact is sometimes overlooked. In some instances the success of emmer in south-western Ontario has been used as an argument for its cultivation in north-eastern Ontario, Quebec and elsewhere, where the rainfall during July and August is usually considerably greater. The value of emmer in the latter localities is, to say the least, quite doubtful, and its cultivation can be recommended only as an experiment.

Quantity to Sow.—Experiments conducted at the Brandon Experimental Farm show that the best results are obtained by using between 80 and 90 lbs. of grain to the acre. As much as 100 lbs. to the acre might be used to advantage in cases where the seed is entirely free from loose kernels.

Emmer cut green.—Common Emmer is sometimes cut green and dried for fodder. It has considerable value in this form, but great care must be exercised not to allow the crop to approach too closely to maturity before cutting, as the awns on the emmer heads sometimes make the fodder most objectionable if they are well developed.

Ground Emmer.—Probably the best way in which to make use of emmer is to grind the threshed grain (with husk adhering). When prepared in this manner it makes an acceptable and valuable food for animals.

EMMER COMPARED WITH WHEAT.

Comparisons between wheat and emmer are often made in such a manner as to be extremely misleading. The bushel of emmer (at 34 lbs. or some such weight) is sometimes compared with the bushel of wheat (at 60 lbs.), and even when the grains are compared on the basis of the actual weight of crop produced, it is not customary to make any allowance for the chaff present in the emmer. It is easy by such means to show great superiority on the part of the emmer. In view of these facts a few comparisons on a fair basis may not be without value.

Common Emmer usually contains about 21 or 22 per cent of husk, but, when occasional free kernels are present, the percentage is less. For the purpose of comparing the yield with that of wheat we may reckon the husk at 20 per cent, thus giving the emmer the benefit of the doubt.

Ottawa, Ont.—Calculated in this way, we find that during the years 1901, 1902 and 1903 (the full length of time for which figures are available), the average yield per acre at the Experimental Farm at Ottawa of emmer and of four varieties of wheat has been as follows:—

Common Emmer (kernels)	1,176	lbs. per acre.
Goose (macaroni wheat)	1,577	" "
Roumanian (macaroni wheat)	1,857	" "
Red Fife wheat	1,861	" "
Preston wheat	2,033	" "

In so far as the last three seasons can be taken as representative, the records show emmer to be strikingly less productive than the best varieties of wheat in the climate of Ottawa.

Nappan, N.S.—A similar comparison for the last four years at the Nappan Experimental Farm gives the following figures:—

Common Emmer kernels	1,696	lbs. per acre.
Goose	1,910	" "
Roumanian	2,200	" "
Red Fife	2,240	" "
Preston	2,210	" "

The great inferiority of emmer, as regards yield, in the climate of this part of Nova Scotia, is here clearly demonstrated.

Brandon, Man.—A comparison of the records for the last four years at the Brandon Experimental Farm shows as follows:—

Common Emmer kernels	2,034	lbs. per acre.
Goose	2,468	" "
Roumanian	2,245	" "
Red Fife	1,725	" "
Preston	1,450	" "

Here we find that Common Emmer has given a yield considerably greater than either of the varieties of wheat grown for the production of flour, but not so large a yield as the best macaroni wheats.

Indian Head, N.W.T.—A comparison for the same years at the Indian Head Experimental Farm gives the following average results:—

Common Emmer kernels	2,056	lbs. per acre.
Goose	2,563	" "
Roumanian	2,355	" "
Red Fife	2,328	" "
Preston	2,468	" "

At this farm the yield of emmer is lower than that of any of the four varieties of wheat.

Agassiz, B.C.—The averages of the crop returns for the last years at the Experimental Farm at Agassiz are as follows:—

Common Emmer kernels	1,808	lbs. per acre.
Goose	2,477	" "
Roumanian	2,667	" "
Red Fife	2,495	" "
Preston	2,622	" "

In this case the yield of emmer is much below that of the four varieties of wheat.

SUMMARY OF COMPARISONS BETWEEN EMMER AND WHEAT.

It will be seen from the figures given above that emmer has been distinctly less productive than the best wheats, except at Brandon, where, although it yielded more than Red Fife and Preston, it was still inferior in crop to Goose and Roumanian. Though these conclusions are drawn from a comparatively small series of tests (three or four years) and are not, therefore, to be regarded as final, they indicate clearly that Common Emmer cannot generally be depended upon to give as large a crop of grain as the most productive varieties of wheat.

COMMON EMMER COMPARED WITH OATS AND BARLEY.

In order to arrive at a fair basis for comparison among these cereals, it is necessary to deduct from each the amount of husk or chaff present. This is here reckoned at 30 per cent for Banner oats, 12 per cent for Mensury barley and 20 per cent for Common Emmer. Of course, this material is not by any means worthless for feeding purposes, nor is it strictly accurate to assume that equal weights of the kernels of these different grains are of equal nutritive value. The analyses of Banner oats published in the Report of the Experimental Farms for 1903, page 135, and the analyses given at the end of this bulletin show considerable differences in composition in the kernels of these different classes of cereals. The kernels of Banner oats, for instance, contain relatively a very large percentage of fat ; and both Banner oat kernels and the kernels of Common Emmer contain a distinctly higher proportion of albuminoids than the kernels of Mensury barley. In carbohydrates, however, barley kernels are better than those of oats, and perhaps superior to Common Emmer also. The full discussion of these differences would require more analytical data than are at present available; and no attempt will therefore be made in this bulletin to state with precision the relative values of equal weights of the kernels of these cereals.

Ottawa, Ont.—The averages of the returns of the past three years at the Experimental Farm at Ottawa are as follows:—

Common Emmer kernels	1,176	lbs. per acre.
Mensury barley kernels	2,000	" "
Banner oat kernels	1,596	" "

These differences are very striking, and show the marked inferiority of the emmer in this climate.

Nappan, N.S.—The averages in this case are calculated from the yields obtained for four years:—

Common Emmer kernels	1,696	lbs. per acre.
Mensury barley kernels	2,394	" "
Banner oat kernels	1,925	" "

These results are similar to those obtained at Ottawa.

Brandon, Man.—At the Experimental Farm at Brandon the plot of Mensury barley failed in 1902 and the plot of Banner oats was almost a total failure in 1900, so that a fair basis for comparison with Common Emmer is difficult to arrive at unless we omit the year 1902 when considering the barley, and the year 1900 when considering the oats. Calculated in this way we find that Common Emmer gave 2,158 lbs. per acre of kernels, as compared with 2,264 lbs. for Mensury barley. On the other hand, Common Emmer gave 1,982 lbs. per acre of kernels, as compared with 1,904 lbs. for Banner oats.

Indian Head, N.W.T.—The comparisons made at the Experimental Farm at Indian Head are based on the crops obtained in the last four years:—

Common Emmer kernels	2,056	lbs. per acre.
Mensury barley kernels	2,495	" "
Banner oat kernels	2,288	" "

Agassiz, B.C.—The average yields at this farm have been calculated from the returns for three years only:—

Common Emmer kernels	1,808	lbs. per acre.
Mensury barley kernels	2,511	" "
Banner oat kernels	1,918	" "

It will be observed that Mensury barley has given a larger yield than Common Emmer at all the experimental farms, and that the Banner oat has given a larger yield than Common Emmer at every farm except Brandon.

CONCLUSIONS.

The yield of Common Emmer obtained at the several Experimental Farms during the past three or four years has been shown to be almost uniformly lower than that of the best varieties of wheat, barley and oats; and it does not appear that in the climates represented by these farms the cultivation of this cereal will prove at all remarkably profitable. It must be noted, however, that the results obtained at Brandon are more favourable to the emmer than those obtained at the other farms. In the Brandon district emmer appears to rank approximately with oats and barley in productiveness, and by way of variety would no doubt prove of value as food for cattle. It should be observed also that, as none of the experimental farms are situated in a dry climate, the experience here recorded with regard to this grain is not to be accepted as a guide for districts where prolonged droughts are of frequent occurrence; yet even in such regions it is possible that some of the varieties of macaroni wheat would prove more productive than emmer, while yielding grain of similar character and perhaps of equal value for feeding purposes.

During the absence of the Chemist of Experimental Farms, Mr. F. T. Shutt, some analyses of emmer and spelt have been made for publication in this bulletin by the assistant chemist, Mr. A. T. Charron, and the second assistant chemist, Mr. H. W. Charlton. The results of this work are given in the following report prepared by Mr. Charron:—

REPORT OF THE CHEMICAL DIVISION ON ANALYSES OF EMMER AND SPELT

BY

A. T. CHARRON, M.A.,
Assistant Chemist, Dominion Experimental Farms.

The following table gives the results of a complete analysis of two varieties of emmer and two varieties of spelt. It has been thought desirable to analyse not only the grain with the hull as it comes from the threshing machine, but also the hulls and kernels after they have been carefully separated by hand.

COMPOSITION of Emmer and Spelt : Whole Grain, Kernels and Hulls.

Designation.	Proportion of Kernels and Hulls.	Moisture.	Albuminoids.	Fat.	Carbohydrates.	Fibre.	Ash.
Red Emmer—							
Whole grain	.....	8·04	13·00	1·84	63·64	10·32	3·16
Kernels	77·82	9·07	15·93	2·12	67·84	2·83	2·21
Hulls	22·18	6·40	3·87	1·06	47·66	35·99	6·02
Common Emmer—							
Whole grain	.....	9·81	12·31	2·41	62·10	9·86	3·51
Kernels	77·32	9·99	14·25	2·75	68·78	2·06	2·17
Hulls	22·68	7·55	3·44	1·07	43·60	35·76	8·58
Red Spelt—							
Whole grain	.....	8·33	12·31	2·03	59·26	14·09	3·98
Kernels	69·50	9·51	16·44	2·67	67·25	1·96	2·17
Hulls	30·50	7·50	5·81	0·59	45·64	34·51	5·95
White-bearded Spelt—							
Whole grain	.....	7·48	12·19	1·90	61·77	13·05	3·61
Kernels	71·80	8·82	15·62	2·03	68·78	1·96	2·79
Hulls	28·20	5·37	4·69	0·77	47·67	35·86	5·70

It may be well to briefly state here the significance and relative importance of the various constituents determined by analysis.

Albuminoids.—This is the most important nutrient in all feeding stuffs, from the fact that it contains nitrogen, which is absent in all the other constituents of fodders. Nitrogen is indispensable to the animal for the formation of its flesh and the casein of milk.

Fat.—The fat or ether extract is the next most important constituent of feeding stuffs. Its principal function is the production of fat and heat. Owing to the high proportion of carbon it contains, fat is over twice as effective as the same weight of carbohydrates in producing heat.

Carbohydrates.—Under this name are included sugars, starch, gums, etc. Carbohydrates have the same function in the animal economy as fat.

Fibre.—This constituent is the least valuable in a fodder. It forms a very large proportion of the hulls, but serves a useful purpose in separating the more compact

particles of concentrated foods, rendering them more easily permeable to the digestive fluids.

The results in the table show that the feeding value of the kernels of spelt is somewhat higher than that of the emmer kernels. The hulls of spelt also have a slightly higher feeding value than those of emmer. But when the whole grain is considered the larger proportion of hull present in spelt makes it less valuable, weight for weight, than emmer.

In comparing the nutritive values of emmer and spelt with Mensury barley (the hulls being present in all cases) we find that the latter is very slightly superior. Recent determinations (made in the laboratories of this division) of the albuminoids in Mensury barley have given the following results:—

Albuminoids in whole grain....	12·50 per cent.
Albuminoids in kernels (free from hulls)..... ..	12·75 "

From the foregoing data it is evident that red emmer (whole grain) is slightly superior to Mensury barley, but in the three other cases the barley seems to have the advantage. The kernels of emmer and spelt, however, contain about three per cent of albuminoids more than the kernels of Mensury barley.

T33
.E22

UNIV. OF MICH.
NOV 21 1904

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

ALFALFA OR LUCERN

(*Medicago sativa*, L.)

ITS CULTURE, USE AND VALUE

Part I.—By J. H. GRISDALE, B. Agr.
Agriculturist of the Central Experimental Farm

Part II.—By F. T. SHUTT, M.A.
Chemist, Dominion Experimental Farms

Part III.—By J. FLETCHER, LL.D.
Entomologist and Botanist, Dominion Experimental Farms

BULLETIN No. 46

JUNE, 1904

PUBLISHED BY DIRECTION OF THE HON. SYDNEY FISHER, MINISTER OF AGRICULTURE.

To the Honourable
The Minister of Agriculture.

SIR,—I take pleasure in submitting for your approval Bulletin No. 46 of the Experimental Farm series on Alfalfa or Lucern. This bulletin consists of three parts.

Part 1 has been prepared by J. H. Grisdale, Agriculturist of the Central Experimental Farm; part 2 by Frank T. Shutt, Chemist of the Experimental Farms, and part 3 by James Fletcher, Entomologist and Botanist of the Experimental Farms.

The economy of growing alfalfa for the feeding of stock and for ploughing under to enrich the soil has not yet been fully realized by the farmers of Canada. The adaptability of this plant to many of the climatic conditions found in this country, its deep rooting habit which gives it the power of drawing moisture and plant food from depths not reached by other plants, and the large quantities of palatable and nutritious fodder it produces, all combine to make it a most desirable crop. Further, the ploughing under and decay of the roots, stems, and leaves of this plant adds largely to the available plant food contained in the soil, and thus furnishes nutriment for succeeding crops.

It is hoped that the facts submitted in this bulletin will induce many Canadian farmers to sow some portion of their land with this useful fodder crop, and that thus the benefits arising from its cultivation may become more generally known.

I have the honour to be
Your obedient servant,

WM. SAUNDERS,
Director Experimental Farms.

Ottawa, June 28, 1904.

PART I.

ALFALFA OR LUCERN: ITS CULTIVATION AND USE.

BY

J. H. GRISDALE, B. AGR., AGRICULTURIST, CENTRAL EXPERIMENTAL FARM.

Alfalfa or Lucern is grown in Canada more or less extensively from the Atlantic to the Pacific ocean. It is the staple forage plant for winter feeding in the drier parts of British Columbia, and it has been grown in Southern Alberta for many years. It is not much known in Manitoba, but is possible of easy propagation in almost all parts of Ontario. It is, and has been grown long and successfully in Quebec, and is not unknown in Nova Scotia and New Brunswick. In Prince Edward Island, whether due to lack of interest or some peculiar climatic or soil condition, it has never, so far as the writer knows, been grown with success.

It has been grown with varying success for many years on the different farms included in the system of Dominion Experimental Farms. The first trials in most cases proved more or less discouraging, but experience gradually acquired rendered later experiments more successful. At Ottawa in recent years a failure with this crop has been practically unknown, and stands eight and nine years old can be shown. At Brandon in Manitoba a plot sown in 1896 has been giving crops varying from 1 ton, 1,500 lbs., to 3 tons, 1,500 lbs., annually ever since. It is therefore apparently quite hardy in that part of the province. It might be stated, however, that 60 lbs. of seed of unknown vitality was sown to the acre in the case mentioned, a larger quantity than we have ever found necessary. In Assiniboia, at Indian Head, Mr. Mackay sowed a plot of Turkestan Alfalfa in 1900 which came through the winter in good shape, but was turned under without any crop being harvested. Common alfalfa seed was sown on a half-acre plot at the rate of about 30 lbs. per acre in 1902. It came safely through the winter of 1902-3 and gave a crop of 1 ton, 1,812 lbs., per acre in the summer of 1903. At latest reports it is still standing and doing well. At Nappan, Mr. Robertson has grown it with rather poor success for three years. At Agassiz, conditions do not favour this crop, but as stated elsewhere, it is very extensively grown in some parts of British Columbia, as for instance, in the Kamloops and other of the dry interior districts. The writer has seen it growing at Calgary, Alberta, and has been credibly informed that it has been growing for over twenty years at Maple Creek, Assa.

As stated, it has been grown in almost every province to a greater or less extent. That it has not been grown more largely seems due to two things, first, that very little is known about its good qualities as a forage plant and, second, that very few know the proper methods of cultivation and its peculiar soil and moisture requirements.

Without careful observance of its peculiar requirements success may not be hoped for, but a careful study of, and compliance with these is amply repaid by almost certain success and large returns.

THE PLANT.

Lucern is another name for Alfalfa. It is a leguminous plant just as are peas, beans and clovers. Plants of this family are all rich in protein (see part II.)

Alfalfa is a perennial, that is a plant capable of living many years under favourable conditions. It is upright and branching in its habit of growth, the mature plants varying in height from 1 to 3½ feet. Its leaves are three parted, the leaflets being narrowly oblong in outline. Its flowers are purple, and are arranged like those of the vetch rather than as those of the clovers. It sometimes produces seeds in Canada in small quantities.

The stem is rather woody, which characteristic develops very rapidly as maturity approaches. The leaves are attached by slender stems which become very brittle when the somewhat matured plant is dried.

The roots penetrate deeply into the soil. It has a tap root (see illustration page 12) which has been known to go to great depths where the subsoil was permeable.

The rootlets bear nodules which enable it to secure its nitrogen supply from the air. 'The young plant consists of a number of low branches springing from a simple basal stalk at the crown of the root. These branches ascend directly above ground and form a compact tuft. On the old plant, however, certain of the more robust stems elongate underground and become new branch-producing stocks.

In this way the simple stock or rhizome becomes two or many-headed.' (For fuller description of plant and illustration see part III.)

SOILS.

As just stated, alfalfa is a deep-rooted plant, hence in considering soil suitable for this crop the character of the subsoil must always be of primary consideration. Two qualities are absolutely necessary in the subsoil for an alfalfa crop to succeed. It must be well drained to a depth of at least 2 feet, and it must be possible of penetration by the roots of the alfalfa plant to a similar or greater depth.

Any field likely to be under water, or the soil saturated with water at any time, for more than thirty-six hours at a time, is quite unsuitable for alfalfa. Any field with a hard-pan subsoil within two feet of the surface will prove unsatisfactory for alfalfa.

The most suitable soil conditions for securing a good stand of plants and securing good and continuous crops afterwards, are a light sandy loam in good heart over a deep loose alluvial subsoil.

A subsoil rich in plant food is of course very valuable, but, while fertility in the subsoil is important, permeability is still more to be sought after. A sandy subsoil while not in itself so rich in plant food is likely to give much better results than a clayey subsoil under a similar surface soil. Upon the fertility and physical condition of the surface soil more than any other factors depend the success of the first year. The success or failure of later years depends in a great measure upon the subsoil.

SOIL PREPARATION.

To insure a good stand three conditions are necessary in the land selected:

1. Freedom from weeds.
2. Excellent physical condition or tilth.
3. Abundance of plant food.

Freedom from weeds may be secured by sowing immediately after a hoed crop as potatoes, corn or roots, or by sowing after a complete or a partial summer fallow. Clover sod, stubble, or even old meadow ploughed shallow in August, rolled and cultivated at frequent intervals during September, and receiving proper treatment in October, may be expected to give good results. In October it should be ploughed again with a subsoiler attached to the plough, or ploughed with two ploughs, one without a mould board following in the track of the other, and stirring the subsoil as much as possible, or cultivated lengthwise, crosswise and angling with a strong stiff-toothed cultivator, to be fallowed by a double mould board plough, leaving the whole field in ridges about 7 inches high and 22 inches apart.

Such treatment insures a seed bed permeable to early roots, fairly rich in plant food, and in excellent physical condition. The latter condition is insured by the retention of the humus or decayed vegetable matter (roots, fallen leaves, &c., of previous crop) in the surface soil, and by the facilities for drainage afforded by the ridging of the surface soil and consequent exposure of the upper subsoil to the effects of the frost.

In the spring as early as possible the proposed alfalfa field should be prepared for seeding. The preparation should consist of frequent cultivations, harrowings and rollings until the seed bed is perfectly smooth and mellow.

SOWING THE SEED.

Alfalfa may be started successfully with a nurse crop. Where preferred it may be sown alone. In either case, a liberal seeding of good germinable seed is necessary. Before purchase a sample of the seed should be secured and tested for germination. It should show over 90 strong germinable seed to the 100. Such seed should be sown at the rate of 25 lbs. to the acre. Seed showing a less percentage of germination must be sown more thickly.

Particularly strong heavy soil may be expected to give somewhat better results when a nurse crop is used. Oats, wheat or barley may be used for this purpose. It is probably better to sow somewhat less than the regular amount of grain to the acre, of the sort chosen when sowing as a nurse crop. Some growers advise about half a bushel of seed of the nurse crop to the acre no matter what kind is used, but, with climatic conditions such as maintain in Ottawa, it would not be advisable to sow such small quantities. The drier the climate the smaller the amount of seed of the nurse crop it is advisable to sow. It would seem wise to sow the usual amount of seed per acre of the nurse crop selected (oats 2½ bus., wheat 1½ bus., and barley 1¾ bus. per acre) for the Maritime Provinces, Quebec and Eastern Ontario; about half the regular seeding in central and western Ontario; no nurse crop in Manitoba nor in the North-west Territories; and in British Columbia more or less than half a seeding according to the particular district.

With light soils it is usually better to use no nurse crop, but the state of fertility of the particular field should always be considered. A light soil rich in plant food and humus would indicate strongly the use of a nurse crop.

The seed should be sown only after the field is in a state of almost perfect tilth. No cultivation, or at most very little, should be given after the seeding is done. The seed may be sown either broadcast or in drills. Sowing the seed from the grass seed spouts of the average seeder is probably the best method. The spouts should be pointing backwards rather than forward. The ground should be rolled shortly after seeding, and the surface lightly scratched with a brush harrow, a breed weeder or a tilting harrow fairly well tilted back. This latter operation is to prevent evaporation and is necessary only in dry times or in localities having small rainfall.

Any person sufficiently interested to try a small plot should prepare the seed bed thoroughly as indicated above, then sow in rows from 7 to 9 inches or further apart. Another method which we have found very successful is to sow shallow in rows about 15 inches apart and cultivate between the rows. The treatment prescribed for the first season 'without nurse crop' should otherwise be the same as for larger areas.

TREATMENT DURING FIRST SEASON.

The first summer is a critical time in the life of the alfalfa plant.

Without Nurse Crop.—Young alfalfa plants are very tender and must be given no rough teatment before they are well established, but the field must be mown and mown often during the first year to insure success. Blooms should never be allowed to appear. The crop should be cut as often as it reaches 8 to 10 inches in height. Frequent cuttings keep down weeds, aid root development and encourage growth. The clippings should, in almost every case, be left on the field as a mulch. As wide cutting a mower as possible should be used and the sickle bar should be tilted to avoid cutting too close.

With Nurse Crop.—During the growing period of the nurse crop no attention is necessary. As harvest time draws on, however, careful watch must be kept to see that the young alfalfa plants are not being smothered by lodging grain. If success with alfalfa is the chief aim, no crop should be allowed to lie lodged upon it for more than three or four days. When harvesting, the machine should be set to cut 5 or 6 inches from the ground. Shocks should not be allowed to stand for more than two days on the same spot, they would smother out the alfalfa.

It is not advisable to allow live stock of any kind to graze upon an alfalfa field the first season, but it is not advisable to leave a very high growth to be crushed down

by the winter snow. The best plan is to cut at a height of about 5 inches from the ground in Sptember and then leave untouched for the rest of the season.

FEEDING VALUE.

As a feed for stock alfalfa may be used in several ways. For the exact composition and comparative feeding value see Part. II.

Pasture.—It is frequently used as pasture and judging by our experiments here has no equal among forage plants for palatability, grazing capacity per acre and food value. All classes of live stock soon learn to like it and thrive upon it. As a pasture for dairy cows it cannot be surpassed. Sheep thrive upon it exceedingly. Swine are very fond of it and do well upon it as a sole feed. Horses eat it with avidity and improve in condition upon such pasture. In a trial here with dairy cows it seemed to be worth much more than any of the grasses or clovers tested at the same time (red clover, alsike clover, timothy, brome grass and orchard grass).

It should not, however, be pastured too closely at any time. Such treatment would be particularly dangerous the second season. Sheep allowed to crop it closely do very great injury. Another disadvantage is that the trampling of the stock hardens the soil and slowly but surely kills out the catch.

Precautions must be taken too, where it is grazed, to prevent injury to the animals grazing. Cattle and sheep sometimes bloat when allowed to eat it wet with rain or dew. Such stock should be turned in only when the alfalfa is dry or when they have just had a feed of some other forage. Bloating occurs very seldom, but it occurs occasionally, and it is well to avoid any possibility of loss in this way. Hogs and horses are not subject to bloat.

As Ensilage.—Mixed with corn or red clover it is exceedingly valuable for making into ensilage. We have never tried it as an ensilage plant by itself. It has been so used, however, elsewhere and has given good results. In districts where wet weather usually prevails in June the conversion of the first cutting into ensilage would be the most practical way of saving the crop in palatable and nutritious form.

As Soiling Crop.—It is as a soiling crop for dairy cattle that alfalfa is particularly valuable. It makes a very rapid early spring growth and is usually ready to cut before any other green feed. It may be cut for this purpose before any blossoms appear, and will thus admit of being cut about four times in the season in this district. No other soiling crop approaches it in value as a feed for milk production.

It may also be used as a soiling crop for pigs. Where so used it may be expected to reduce the cost of producing pork by from 25 to 50 per cent in comparison with pigs fed on grain alone.

To give the best results when used for this purpose it should be cut before any blossoms appear, even earlier than when cut to feed to cows. Feed all the pigs will eat up clean. It should be fed both morning and evening.

To summarize, alfalfa used as a soiling crop may be expected to produce from 15 to 24 tons per acre of the finest kind of green forage, most palatable, very nutritions and suitable for horses, cattle, sheep and swine.

As Hay.—It is as a hay crop that alfalfa has won fame and place in British Columbia and the United States, and it is undoubtedly possible of extensive use for that purpose wherever it can be successfully grown in Canada. Under favourable soil and weather conditions it may be expected to produce from five to six tons of hay to the acre per annum.

Alfalfa hay, well made, has no equal as a dry feed for live stock, but no other kind of hay requires as much care, skill and experience or information in the making as does alfalfa.

As the plant begins to blossom its stems begin to turn woody. Plants far advanced in the blossoming stage have very woody stems, easily lose their leaves and then make unpalatable, indigestible and generally inferior hay.

It is evident, therefore, that to secure good results the crop should be cut at an early stage. Experience has shown the beginning of the blossoming stage to be the best time. The very best time is when about 10 per cent of the blossoms are in

bloom. It is then in its best feeding condition and will come along most rapidly for the next cutting. If the cutting be delayed not only will the hay cured be of an inferior quality, but recovery will be slow and incomplete, entailing a smaller total yield for the year than would otherwise have been produced.

THE MAKING OF THE HAY.

No more than can be conveniently handled in one day should be cut at one time. It is best to cut in the morning as soon as free from dew. Leave in the swath, or preferably shake up with the tedder at intervals till late afternoon or until the hay is well wilted, but not dry enough to lose its leaves, then rake into windrows. If rain threatens put into cock for the night and open out in the morning to finish curing. It should be cured until it will keep without heating, but not made so dry as to cause the leaves to drop off. In the curing and housing it should be handled as little as possible, as each handling means the loss of a considerable number of leaves, and the leaves are, by very much, the more valuable part of the crop.

Alfalfa hay should, if at all possible, be made without getting wet with rain. After being exposed to rain in the curing it is not worth nearly so much for feed, losing probably half its value. The rain not only causes many more leaves to fall off, but seems to remove much of the palatability, digestibility and food elements of the remaining leaves and stems.

It should be well protected when cured, as it absorbs rather than sheds rain. If stored in stacks, a thatch, a canvas, or a lapping board roof should be put on.

ITS FERTILIZING NEEDS.

Just as when sown to clovers and other legumes, both the physical condition and the average plant food content of a soil are improved and increased rather than injured or depleted by being under alfalfa for a time. Certain amounts of the chief elements of plant food are, however, removed by each crop and the application of farm yard manure in the fall at the rate of say 10 tons per acre every four years will prove profitable. If it is desired to supplement an insufficient supply of barnyard manure, the following dressing of commercial fertilizer per acre will most likely be found valuable: 30 lbs. nitrate of soda, 300 lbs. bone meal, and 80 lbs. muriate of potash.

ITS FERTILIZER VALUE.

It is as a soil renovator or improver that alfalfa growing is frequently advocated. As mentioned above, however, soil in fairly good heart is necessary to get the crop started. But once started there is no doubt that it has great value as a factor in the improvement of the physical condition and in increasing the fertility of the field where grown. For a full discussion of its value in this connection see Part II, but an examination of the cut on page 12 will show the depth of root the plant throws out. These roots are valuable not only on account of the plant food they supply when decomposing in the soil, but are valuable because they open up the subsoil and render it more permeable to surface water, so improving the soil very materially. Undoubtedly the long roots bring up from depths not reached by the roots of other plants much of the food required by the plant, hence the importance of such roots and the great value to agriculture of the plant that is able to produce them.

SUMMARY.

1. Sow sufficient seed.
2. Sow good seed, that is germinable seed.
3. Sow on well-prepared land in good state of fertility.
4. Sowing without nurse crop overcomes in some measure poverty of soil.
5. Proper preparation of the right kind of seed bed and careful observance of directions for first year treatment are necessary to insure a long series of remunerative crops.
6. Before sowing be sure that a sufficiency of plant food exists in the surface soil to grow a good crop (40 bushels to the acre) of oats.
7. Do not sow on poorly drained land; 'well drained' should mean drained to a depth of at least two feet.

PART II.

ALFALFA: A FODDER AND A FERTILIZER.

BY

FRANK T. SHUTT, M.A., CHEMIST, DOMINION EXPERIMENTAL FARMS.

AS A FODDER.

Alfalfa merits attention, both as a fodder and as a fertilizer. As the former, it furnishes a large amount of forage especially rich in flesh-forming constituents and as the latter it may be employed with advantage to maintain and increase soil fertility by the addition of considerable stores of nitrogen and humus.

Alfalfa is a legume—a class of plants including the clovers, peas, beans, vetches, &c., and characterized by possessing a large proportion of nitrogenous matter (crude protein) in their tissues. The legumes are further remarkable for their peculiar and valuable property of being able to draw upon that inexhaustible store—the air—for the greater part of the nitrogen they possess. It is this latter fact that distinguishes the legumes from all other plants and which has given them the name of 'nitrogen collectors.' All other plants are 'nitrogen consumers': that is, they draw their supply from the soil and consequently by their growth leave the soil poorer in this element. For many centuries it was considered that the growth of legumes enriched rather than improverished the soil, increasing the yield of subsequent crops of grain, roots, &c., but the definite knowledge of the fact and how it was brought about dates back but a few years and must be regarded as the most important discovery in agricultural science of the nineteenth century.*

Without discussing in any detail the constituents of fodders and their function in the animal economy, it may suffice for present purposes to point out that the value of a forage crop depends chiefly on the amount of 'dry matter' it furnishes and the relative richness of this dry matter in the flesh-formers or protein. In the following table the composition of a number of our more common coarse fodders is given, allowing a comparative study to be made of their relative feeding values.

COMPOSITION of Coarse Fodders.

Name.	Water.	Dry Matter.	Crude Protein.	Ether Extract or Fat.	Nitrogen-free Extract or Carbo-hydrates.	Fibre.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Alfalfa, green	71·8	28·2	4·8	1·0	12·3	7·4	2·7
" hay	8·4	91·6	14·3	2·2	42·7	25·0	7·4
Red Clover, green	70·8	29·2	4·4	1·1	13·5	8·1	2·1
" hay	15·3	84·7	12·3	3·3	38·1	24·8	6·2
Timothy, green	71·0	29·0	2·3	0·9	15·4	8·8	1·6
" hay	13·2	86·8	5·9	2·5	45·0	29·0	4·4
June grass, green	73·1	26·9	3·1	1·1	13·4	7·0	2·1
" hay	15·3	84·7	7·4	2·5	42·1	27·2	5·5
Corn forage, green	79·3	20·7	1·8	0·5	12·2	5·0	1·2
" silage	79·1	20·9	1·7	0·8	11·0	6·0	1·4
Mangel	90·9	9·1	1·4	0·2	5·5	0·9	1·1

It is evident from the foregoing that alfalfa, in common with clover and other legumes, furnishes a more nutritious fodder, weight for weight, than the grasses,

* The means by which the legumes are able to appropriate the free nitrogen of the air may be briefly stated as follows: There are certain micro-organisms or bacteria present in the soil which are able, when attached to the roots of the growing legume, to utilize the nitrogen of the air existing between the particles of the soil, and to pass it on in some organized form to their host plant, enriching its tissues of root, stem, and leaves. The attachment and growth of these bacteria cause the formation of nodules or tubercles on the roots of the legume, and these nodules, swarming with their countless inhabitants, are to be found in sizes varying from that of a pin's head to that of a pea or larger, and frequently scattered in large numbers over the roots of the plant.

Indian corn or roots, and it, therefore, only remains to present certain particulars respecting its composition at various stages of growth and to detail the amounts of real cattle food obtained per acre by a greater or less frequency of cutting during the season.

THE YIELD OF ALFALFA FROM TWO AND FOUR CUTTINGS, RESPECTIVELY.

In the irrigated districts of the Western States, alfalfa is the most important and most valuable of all fodder crops, being cut from six to eight times in a season and yielding in all from eight to fourteen tons per acre of fodder of a high protein content. Experience in Canada, though limited as yet, shows it to be a forage plant of wide adaptability and capable of producing profitable crops when once established. Though somewhat difficult to cure, owing to the readiness with which the leaves drop off in drying, it possesses characteristics which make it of special value for pasturage and soiling, viz., its very early growth in spring and its property of quickly sending up an aftermath when cut.

To obtain data regarding the relative yields—both as to amount and feeding value—when cutting the crop two and four times, respectively, during the season, certain experiments were made in the year 1901 on the Central Experimental Farm at Ottawa and the results of this investigation may now be presented.

The plot of our experiment was sown in May of the previous year, so that the results indicate returns from the second season's growth. Half the plot was cut twice and half four times, and the several yields weighed and analysed. The following are the data.

TABLE I.—Yield and Amount of Dry Matter from Two and Four cuttings, respectively.

Date of Cutting.	Average Height of Plants.	Two Cuttings—Per Acre.			Four Cuttings—Per Acre.		
		Weight of Crop.	Dry Matter.	Crude Protein.	Weight of Crop.	Dry Matter.	Crude Protein.
	Inches.	Tons. Lbs.	Tons. Lbs.	Lbs.	Tons. Lbs.	Tons. Lbs.	Lbs.
June 4	*30	.....	.....	.....	6 920	1 610	522
" 21	†39	12 1,600	3 297	1,027	.....	.....	.....
July 15	‡28	.....	.....	.....	4 960	1 438	368
Aug. 1	§20	4 320	1 445	384	.....	.....	.....
" 19	**20	.....	.....	.....	5 1,120	1 329	473
Sept. 18	††20	.....	.....	.....	2 1,760	1,168	295
Total	.....	16 1,920	4 742	1,411	19 760	4 545	1,658

* About one week before blooming. † Just bursting into bloom. ‡ About half the plants in bloom. § About one-tenth of plants in bloom. ** No bloom showing. †† No bloom showing.

The composition of the foregoing yields, as regards water and dry matter, is given in the following table:—

TABLE II.—Dry Matter in Crop cut at various times throughout the Season.

Date of Cutting.	Plot cut twice.		Plot cut four times.	
	Water.	Dry Matter.	Water.	Dry Matter.
	Per cent.	Per cent.	Per cent.	Per cent.
June 4	.....	.....	79·8	20·2
" 21	75·4	24.6	.....	.....
July 15	.....	.....	72·8	27·2
August 1	70·6	29·4	.....	.....
" 19	.....	.....	79·1	20·9
September 18	.....	.....	79·7	20·3

From the foregoing tables it will be seen that the yield of fresh material is greater from the area cut four times than from that cut twice. However, owing to the fact that the average moisture content of the former was higher by about five per cent, the yield from the two cuttings contains more dry matter. The dry matter of the former (four cuttings), however, furnished the more nutritive fodder from the presence of an additional 250 pounds of crude protein. In a word, the plot cut twice gave the more dry matter, and the plot cut four times the more crude protein.

A comparison of the amounts of dry matter and albuminoids* per ton of fresh material in the various cutttings—possibly the most interesting feature in the investigation—is given in the following table:—

TABLE III.—Dry Matter an Albuminoids Per Ton, in Fresh Material.

	Dry matter. Lbs.	Albuminoids. Lbs.
Plot cut twice:		
First cutting (June 21)	492	49
Second cutting (August 1)	588	63
Plot cut four times:		
First cutting (June 4)	404	46
Second cutting (July 15)	544	66
Third cutting (August 19)	419	60
Fourth cutting (September 18)	405	70

The percentage of albuminoids in the dry matter was also determined.

TABLE IV.—Albuminoids in Dry Matter.

	Percentage.
Plot cut twice:	
First cutting (June 21)	10·0
Second cutting (August 1)	10·7
Plot cut four times:	
First cutting (June 4)	11·3
Second cutting (July 15)	12·2
Third cutting (August 19)	14·2
Fourth cutting (September 18)	17·1

From the data of tables III. and IV. it will be seen that the stage of growth influences both the amount of dry matter and the proportion of albuminoids in the dry matter. The later cuttings, weight for weight, will, as a rule, contain more dry matter and invariably furnish a fodder richer in albuminoids than the earlier cuttings. Thus, in the plot cut four times one ton of the fourth cutting (September 18) is equal, as regards albuminoids, to one and a half tons, approximately, of the first cutting (June 4). Similarly, in the case of the plot cut twice, we find the greater feeding value per ton from the second cutting. (See table III.)

In conclusion, we may place side by side the pounds *per acre* of albuminoids from the two and four cuttings of alfalfa, respectively.

ALBUMINOIDS.—POUNDS PER ACRE.

	Plot cut twice. Lbs.	Plot cut four times. Lbs.
June 4	...	74
June 21	156	..
July 15	...	74
August 1	66	..
August 19	...	83
September 18	...	50
	222	281

* The 'crude protein' includes the 'albuminoids' and certain other nitrogenous substances of a less nutritive character—the amides and allied bodies. Upon the proportion of the more important albuminoids (the true flesh-formers) present, the value of the fodder depends.

It is evident, therefore, that although the amount of dry matter was somewhat larger from the plot cut twice, the plot cut four times yielded considerably the larger weight of albuminoids.

ALFALFA AS A FERTILIZER.

The practice of using one or other of the legumes as a 'green manure' is becoming more and more popular, both in the preparation and enrichment of the soil for the ordinary farm corps as well as for the successful and economical cultivation of orchards (see bulletin No. 40, Experimental Farm Series, Clover as a Fertilizer). A few years ago the relative merits of alfalfa and certain clovers in this connection were ascertained at the Central Experimental Farm, Ottawa, and we now append in tabular form the data obtained.

YIELD and Amount of certain Fertilizing Constituents per acre from three months, growth of Clover Crops, Experimental Farm, Ottawa:—

Seed sown July 13, 1896, cut October 20, 1896.	Weight of Crop per acre (green).		Organic matter.	Ash.	Nitrogen.
	Tons.	Lbs.	Lbs.	Lbs.	Lbs.
Alfalfa—					
Stems and leaves	5	1,192	2,664	510	75
Roots	5	558	3,120	613	61
Total	10	1,750	5,784	1,123	136
Mammoth Red—					
Stems and leaves	6	1,310	2,269	508	82
Roots	3	1,260	1,409	219	48
Total	10	570	3,678	727	130
Crimson—					
Stems and leaves	11	234	2,093	602	85
Roots	3	201	801	199	19
Total	14	435	2,894	801	104
*Common Red—					
Stems and leaves	4	1,779	1,842	481	70
Roots	2	1,445	1,394	172	47
Total	7	1,224	3,236	653	117

In the following brief remarks we have brought together the more salient features of this system of green manuring with legumes.

Primarily, it is useful in furnishing nitrogen and humus—the former an essential element of plant food, the latter a most important constituent of soils, both chemically and physically.

When employing rye, buckwheat or other plants not legumes, the nitrogen stored within the tissues of the crop has been obtained from the soil, but with the legumes (clover, pease, &c.) the case is different. They, under favourable conditions, have the power of appropriating the larger part of their nitrogen from the atmosphere; on ac-

* In the experiments here recorded the common red clover has given a much less weight of stems, leaves and roots than the mammoth red clover. In other experiments, however, recorded in bulletin No. 40, pp. 19 and 20, the common red has almost equalled the mammoth red in this particular, and in one instance the weight from the common red was greater. Hence, where there is any difficulty in procuring the seed of the mammoth red the common red may be substituted with good results.

count of this property they have, as already stated, been termed 'nitrogen collectors.' Since nitrogen is the most expensive of all the elements when fertilizers have to be purchased, the value of green manuring with the legumes, which are exceedingly rich in this constituent, becomes apparent.

The humus thus supplied increases the retentive power of light soils for moisture, ameliorates the condition of heavy clays, and regulates the soil temperature. By the carbonic acid liberated in its decay, the inert plant food of the soil is dissolved.

The elements that compose the humus of the legumes, are for the most part derived from the atmosphere, so that in the benefits conferred by the presence of humus and its decomposition there is a distinct gain.

Further, we may well suppose that the mineral matter or ash constituents of the green crop are, by the decay of the latter in the soil, set free in a condition more or less immediately available to plants. Hence, although such a method of manuring has not added to the total store of mineral food in the soil, it has materially enhanced its value by conversion into more assimilable forms.

A consideration of the data in the foregoing table shows that in total yield of crop, alfalfa stood second. It was from this plant we obtained the largest amount of humus in the stems and leaves, as well as in the roots. It also afforded the most nitrogen per acre, nearly half of which was in the roots—a feature in which it stands alone among the clovers experimented with and one of great importance when the crop is intended for soiling or curing. The extensive or rather deep-root system is of much value in the mechanical improvement of the soil; it serves to bring to the surface layers much plant-food ordinarily out of the reach of farm crops.

The mineral matter exceeded by 300 pounds per acre the amount in the Crimson Clover crop—the next best in this respect. More than half of the 1,100 pounds of ash constituents recorded as stored in the yield per acre, was contained in the roots.

Taking into consideration all the important requirements, from a chemical standpoint, of a crop for green manuring, the alfalfa gave the best results in the present investigation.

PART III.

LUCERN OR ALFALFA.

(Medicago sativa, L.)

By James Fletcher, LL.D., F.R.S.C., F.L.S.

The frequent demands for information concerning Lucern or Alfalfa made by farmers from all parts of Canada make it advisable to publish a note, giving briefly some of the more important known facts bearing on the cultivation of this legume, as well as a reference to such success as has attended the efforts of enterprising farmers who have experimented with it. Its great value in the semi-arid districts of western North America, and in many parts of South America, can hardly be overstated. This has doubtless led to the numerous trials which have been made from time to time in almost all parts of the Dominion.

Notwithstanding that these attempts to establish Lucern among the regular fodder crops of Canada must be acknowledged not to have been very successful so far,

Fig. 1.—Lucern : *a*, *b*, seed pod ; *c*, seed — *a*, *b*, *c*, enlarged.

(Jared G. Smith, Farmers' Bulletin No. 31, United States Department of Agriculture.)

yet, from careful observations and inquiries made during a period of many years, the writer feels justified in recommending farmers in all parts of the Dominion to give this clover a much more extensive trial than up to the present time it has received. These experiments should naturally be made on a small scale at first, until the suitability of the locality has been proved. Lucern has been styled 'a fickle crop,' owing to the irregular results which have been obtained in growing it in the same district, or even in two fields close to each other in the same locality.

The most important requisite for success is a permeable, well-drained subsoil, in which the water level does not rise higher than eight or ten feet below the surface. Provided that the actual soil in which the plant grows is tolerably fertile, and that it

has been well prepared, Lucern will succeed on soils of a very diverse nature, ranging from the lightest of sandy loams to heavy clay.

Lucern or Alfalfa (*Medicago sativa,* L.) is an upright branching, deep-rooted smooth perennial plant, belonging to the natural order Leguminosæ, to which also belong the various clovers, pease, beans, vetches and similar plants. For all practical purposes of the farmer, it may be regarded as a clover, and may be put to the same uses. It is precisely the same plant as is frequently spoken of under its other name, Alfalfa, and is not as some of our correspondents have thought, a true grass, such as Timothy, June grass or Millet. The name Lucern, by which this plant is known in Europe and most parts of eastern North America, is not derived from the Swiss Canton of Lucerne, but is said to be a corruption of the old Cataline name 'Userdas,' whence came 'Laouzerdo' used in the south of France, and this word, by easy corruption, has changed to Lucern. The other name, Alfalfa, is of Arabic origin, and was taken with the plant into Spain by the Moors. The Spaniards naturally called the new plant by the name used for it by its introducers, and then brought it with them under that name to North America, where it is now widely used, particularly in the West, where Lucern is most grown, and where Spaniards were formerly numerous. The cultivation of Lucern probably dates further back than that of any other fodder plant known. An interesting account of its history is given in the United States Farmers' Bulletin No. 31. Lucern is a native of valleys of Western Asia, and has been found wild in Beloochistan, Afghanistan and Cashmere. It has been cultivated as a fodder plant for more than two thousand years and was introduced into Greece at the time of the Persian war, B.C. 470. It was brought to Mexico and this continent at the time of the Spanish invasion, since which time it has slowly and gradually spread over the whole continent, until it is now cultivated more or less over vast areas north and south of the equator.

Lucern grows to a height of from one and a half to over three feet at the time of flowering. The proper time to cut the crop is when about one-tenth of the flowers have turned purple. The leaves consist of three oblong leaflets, which are notched at the end and borne each one on a slender stalk. The purple pea-shaped flowers are in long, loose clusters and occur all over the upper part of the plant. The pods are spirally twisted and contain several yellow kidney-shaped seeds, which are about one-half longer than red clover. The root system consists of a single tap-root, which under favourable soil conditions will run down to a great depth, an average of ten or twelve feet being common, and there are authentic records of the roots having penetrated to a depth of over fifty feet. This deep-rooting habit gives the plant great agricultural value as a soil improver by carrying the materials for humus and nitrification of the soil a long way below the surface, and also because the plants not only derive much of their nourishment from depths not reached by ordinary crops, but the vitality of the plant is protected from drought, and when the roots decay, channels useful in the drainage of the subsoil are opened up.

The young plantlet, which for some time after starting from the seed is slender and delicate, is well shown at figure 2. When the stems are cut or grazed off, the stalk dies down to the very base and new buds are produced on the upper part or crown of the root. The plants do not reach full growth until the third year, when they present the appearance shown at figure 3. The crown of each plant by that time produces a great many stems and forms a strong tuft of excellent fodder. Owing to the smallness of the plants the first year, farmers are sometimes disappointed at the appearance of the crop; but if, when the seed has been sown broadcast, one plant can be saved to every five or six inches, the stand will be thick enough. It is best to sow Lucern in drills seven or eight inches apart.

This plant has no running root-stocks, and there is not the slightest probability of its ever becoming a troublesome weed. It spreads only by seed. When it is desired to clear it from land, it can be easily done, although it will require a good plough and a strong team of horses. The roots, once cut below the surface, do not produce new shoots, but die. Under irrigation the plants are easily killed by flooding the fields for three or four days in hot summer weather.

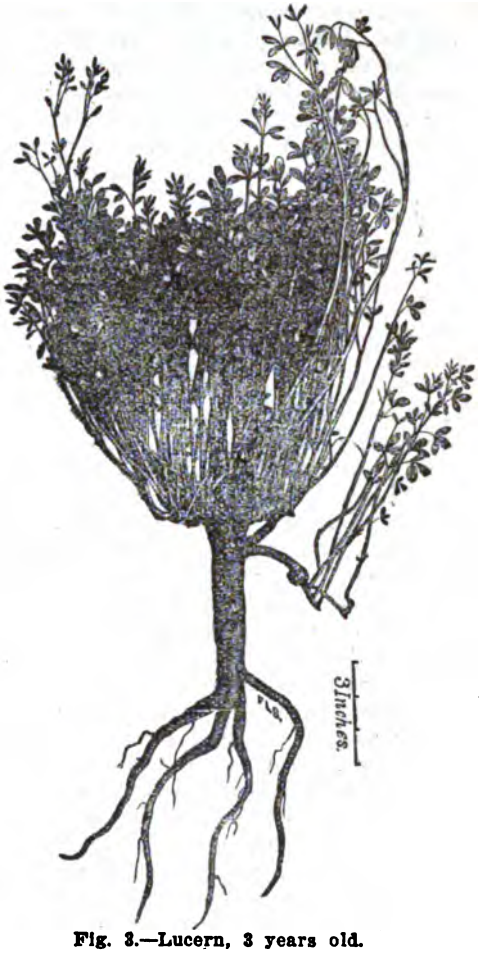


Fig. 2.—Lucern seedling, 6 weeks old. Fig. 3.—Lucern, 3 years old.
(Jared G. Smith, Farmers' Bulletin No. 31, United States Department of Agriculture.)

Lucern is a long-lived perennial, and it is not often advisable to lay down land to this crop unless it can be left undisturbed for several years. The heaviest crops are borne after the third year. On the experimental grass plots at the Central Experimental Farm, we have cut three crops a year, aggregating an average of five tons of cured hay to the acre for nine years, and this too was upon a piece of gravelly and by no means rich land. Ex-Governor Hoard, of Wisconsin, tells me that there are plots of Lucern now growing near some of the old Spanish monasteries in California which were sown fifty years ago.

As stated above, when a piece of well-drained suitable land is to be sown to Lucern, it should be tolerably rich, or in the condition known to farmers as 'in good heart,' that is, fit to give profitable returns from any ordinary farm crop. If it is not, it will be better to put on a good heavy dressing of barn-yard manure, plough deeply and grow a crop of corn or potatoes for the first year. Lucern may be sown either in spring or summer, but does far better when sown in spring. The seed bed must be deep, well firmed but mellow, and with a smooth surface. The disc harrow, roller, and smoothing harrow, should be well used before seeding, until the land is in the very best condition possible. When the young plants are well up, 8 or 10 inches, the field should be mowed and all weeds must be kept down carefully for the first year with scythe and hoe. Any weak spots should be picked up, if necessary, by sowing some more seed before August.

If not put out of sight by the roller, corn roots should be raked off the land before seeding. When sown alone, fifteen to twenty-five pounds of Lucern seed should be used to the acre, and it is generally conceded, particularly in the West, where there is sometimes a lack of moisture, that it thrives best when sown without a nurse crop. However, excellent results have been sometimes secured when the seeding has been done with a light crop of barley or wheat.

With a good stand, a light crop of hay may be taken the first autumn; but it is better to cut and leave this on the field as a winter mulch. Every spring the field should be harrowed before the shoots appear, with a heavy harrow to loosen up the surface and kill weeds. This treatment, with an autumn dressing every three or four years of short barn-yard manure thoroughly composted so as to destroy weed seeds, will keep a well-established field of Lucern in good paying condition for a great many years. Some fields in California, Kansas, Virginia and Colorado have been giving crops continuously for over twenty-five years. Weeds and irregularities in the surface of the land are the two chief causes of failure in keeping Lucern fields up to a paying standard. This shows the importance of very great care in preparing the land before seeding, and, as the field remains under the same crop for many years, more than ordinary outlay is justifiable at the outset.

Where Lucern is to be grown under irrigation in the West, Mr. Jared G. Smith advises (Farmers' Bull. 31, p. 12) that the seed be 'drilled or sown broadcast in spring, as soon as the ground is warm and when danger of hard frost is past. It is best to sow without a nurse crop. Where the land is under ditch, the fields should be irrigated before seeding and not again until the seedlings are at least six weeks old. The first six weeks or two months in the life of the plant is the critical period of its growth. It is at this time very susceptible to any sudden change of temperature or to an excess of water in the soil. If the land be irrigated directly after it has been ploughed and harrowed, the soil becomes a reservoir of water necessary for the growth of the young plants, and no further irrigation will be required until the alfalfa is well established. The seed should be covered very lightly, to a depth not exceeding an inch. A light harrow or brush will be sufficient.'

'Land on which Alfalfa is to succeed must be well drained, as in the East. It is a mistaken idea that Alfalfa fields must be kept continuously water-soaked. The plant cannot make its best development with wet feet. The soil must be deep, rich and mellow, and the ground water not less than six or eight feet below the surface. The soil in which it most delights is dry and well drained, and if, in addition to these qualities, the lay of the field is such that water can be turned on once or twice during a hot, dry summer, the very best conditions for the growth of Alfalfa will be attained.'

It is sometimes desired to grow Lucern mixed with grasses, and this may be done in many parts of the country if varieties are chosen which will not smother out the young seedlings. Mr. D. O'Hara, of Bonaparte, in the Ashcroft district of British Columbia, has grown a mixed crop of Lucern and Awnless Brome with the greatest satisfaction, and reports that others have done the same, and further adds the interesting information that in such a mixture the Lucern is protected to such a degree that in winters, when grown alone, it has winter-killed, while, mixed with some grasses, the plants have come through without injury. In the West, undoubtedly the best kinds of grass for mixing with Lucern would be the Awnless Brome or the Western Rye-grass, which might be mixed in the proportion of ten pounds of Lucern to six pounds of the grass seed. Awnless Brome does not as a rule make a very heavy growth the first season, and therefore it would not crowd out the somewhat delicate Lucern seedlings, nor deprive them of too much soil moisture. The Lucern, being a very deep-rooted plant, would be well suited for cultivation with either of these grasses, the root systems of which are much nearer the surface.

In the East, Meadow Fescue, Tall Oat Grass and Orchard Grass might be used for the same purpose. Timothy flowers too late to make a good mixture, although it has been used to a considerable extent.

In localities where the snowfall is light or cannot be relied on to remain throughout the winter, a light top-dressing of manure in autumn or during the winter is very useful in protecting the young plants.

It is probable that Lucern is one of the most valuable fodder plants known, and that it has a very wide range of usefulness, by far greater than up to the present time has been discovered. It yields heavy crops of from twelve to twenty-four tons to the acre of early, succulent green feed, or from three to six tons of cured hay of the highest quality. In all conditions it is palatable and attractive to every kind of stock and has, besides, a special value on account of the large amount of nitrogen it contains. This valuable plant food increases considerably the utility of manure from animals fed upon Lucern and other leguminous plants. Like all other members of the clover family, this has on its roots nodules or galls inhabited by myriads of minute organisms known as nitrogen-gathering and nitrifying bacteria, which perform the useful offices of collecting nitrogen from the air and changing its condition, so that plants can make use of it as food. The abundance of these nodules varies with the soil in which the plants grow, and the vigour of the plants is directly affected by their abundance. When the seed is sown on new land, there are not nearly so many of these important bodies on the roots as where a crop of Lucern has previously flourished, nor are the plants so vigorous. It has been found that the soil may be easily inoculated so as to be able to grow better crops, by scattering some soil from an old Lucern field or from a spot where the White Sweet Clover, also known as Bokhara Clover (*Melilotus alba,* L.) has grown.

Prof. Cyril G. Hopkins says (Bulletin 94, Illinois Agric. Exp. Station, 1904) : 'We have conclusive evidence that infected sweet clover soil can be used for the inoculation of alfalfa fields. The infected soil may be obtained from any place where sweet clover is found with abundance of tubercles on its roots. The soil may be collected to a depth of three or four inches and scattered over the alfalfa field at the rate of 100 pounds or more to the acre. It is well to scatter the infected soil at about the time the alfalfa is seeded, and harrow it in with the alfalfa seed, although it may be applied some days or even some weeks before seeding time, and probably it would be all right to apply the infected soil the autumn before; for it is known that the bacteria will live in soil for several months, even though the soil be placed in sacks and allowed to become quite dry. Investigations have shown that 100 pounds of thoroughly infected soil to the acre is sufficient to produce a very satisfactory inoculation within one year from the time it is applied.'

It may also possibly be the case, although it has not as yet been proved, that other kinds of these useful nodule-inhabiting bacteria which occur on one kind of leguminous plant, may be able to establish themselves on the roots of other nearly related plants growing near them. A few of the bacteria are probably carried with the seeds to a new locality; but it takes some time before they increase sufficiently to help the crop, and, if some soil can be procured from an old field and scattered over the surface, the plants respond rapidly and much time is saved. That Lucern improves the soil where it is grown, is shown by the remarkable increase in the crops which follow it.

The seed of Lucern can be grown in Canada, but it is more economical at present to import seed and cut the crop for feed or hay.

As stated, Lucern has been tried in every part of the Dominion, and remarkably good results have been obtained in many parts of Ontario, Quebec and British Columbia. One of the finest fields of Lucern which I have ever seen, was at Cowansville, Que. Mr. F. W. Hodson, the Dominion Live Stock Commissioner, has grown Lucern mixed with grasses with the greatest satisfaction, near Myrtle, Ontario, getting from three to four tons to the acre each year for several years, and this on a clay hillside which for many years had been almost bare of vegetation, owing to the heavy nature of the soil and to the steep slope of the hillside, which allowed of much erosion during heavy rains. Several small patches have been grown in Manitoba and Mr. Bedford, the Superintendent of the Manitoba Experimental Farm, writes:—'On this farm, when sown without a nurse crop, Alfalfa, Common Red, Mammoth Red, Alsike and

White Dutch Clovers form robust plants by fall, and do not fail to pass the winter successfully. I sow in spring without a grain crop, because, when sown with grain, Alfalfa and other clovers, but particularly Alfalfa, have been winter-killed, the roots produced during the first year being small and short. I have grown Alfalfa since 1887.'

When travelling through the North-west Territories, I have frequently come across farmers who have small patches of Alfalfa, some of these of three or four years' standing, and Mr. T. N. Willing, of Regina, who, as Provincial Weed Inspector, has exceptional opportunities of seeing what crops are grown on farms in all parts of the North-west Territories, and who, as a practical farmer, is well able to judge the value of crops, writes:—'I am sorry to say I am not aware of any one who is conspicuously successful with Alfalfa on a large scale, although many have tried small patches, which have apparently given most promising results. Mr. W. Stevens, of Cloverbar, near Edmonton, has a patch in its second season, which wintered perfectly; when mowed at the end of July it was between three and four feet high and gave a crop estimated at from three to three and a half tons. Near Battleford, the late Mr. Laurie sowed Alfalfa about 1884; the season was dry, but the plants struggled on in spite of drought and gophers; the farm was subsequently abandoned, but in 1900, the Alfalfa area was still clearly defined and proved attractive to the cattle. Mr. Laurie was satisfied that this would have done well, had he been able to care for it better. A man near Boscurvis has grown Alfalfa for three years, and it has constantly improved. Near Prince Albert it was grown for five years by Mr. Acorn, but was then killed out by a late spring frost.'

Mr. John Dixon, of Maple Creek, Assa., has had an acre and a half of Lucern under cultivation for over twelve years and reports it to be improving every year. The first year it was sown it came up nicely, but so much was killed the next winter that grass was sown on the plot the following spring. However, Lucern appeared later and has continued to improve year by year since that time. The first crop of hay was ready to cut on June 1. Mr. Dixon's plan is to cut once for hay and then let the plants go to seed. He never pastures it and gives it a top-dressing every third or fourth year. The patch is much admired by visitors, and Mr. Dixon's experiment has induced many others in the neighbourhood to try this clover. Less than 100 miles south of Maple Creek, in the State of Montana, Lucern is grown in large quantities, and I can see no reason why it should not do equally well in many parts of our North-west Territories, if the land is carefully prepared. Mr. Dixon, writing of his experiment, says : 'We have tried Lucern in several other places and under different conditions, but without any decided success. It will not succeed in low, wet lands or on land which floods, the stems being very much affected by water. I fancy it thrives best on a sandy loam and under irrigation. The little plantlets are very tender and hard to start. Although they usually die for want of water, yet they are easy to kill if they get too much. We are convinced that a second sowing on the same piece of ground gives better results than the first seeding; that is, should the first sowing not be successful, the same ground should be cultivated and seeded the second time, when a better stand will be secured.'

The Honourable C. F. Cornwall, of Ashcroft, B.C., reporting on his district to the Deputy Minister of Agriculture for British Columbia, 1901, says: 'For stock-feeding Alfalfa and Sainfoin are chiefly grown and are produced in great quantities.'

Besides the ordinary form there are some other species or varieties of Lucern which are cultivated to a certain extent. The Intermediate Lucern, the Yellow or Sand Lucern, and a variety of the common form from Turkestan, and known by the name of Turkestan Alfalfa, are the varieties most grown. Both of the first-named have succeeded well on the Experimental Farm grass plots and have given in this single experiment heavier crops than the ordinary form. All are very much alike, and it is probable that they are merely varieties or forms of one species. The Turkestan Alfalfa appears to be merely a vigorous form which has been grown in Western Asia for a long time and has thus become accustomed to more severe conditions than the common Lucern. The two plants after some years of cultivation are almost indistinguishable, although the Turkestan variety is rather more vigorous in growth.

The facts given above will, I trust, induce some who have not already done so, to try a small plot of this valuable fodder plant. During the last hundred years, outside certain regions in the West and South, reports of successes and failures have been about equally divided, and there must be some reason for the differences in results. I am inclined to think that these are chiefly due to a lack of care in choosing suitable land and in preparing the seed-bed for the reception of the seed. Lucern has succeeded so far north and under such severe winter conditions that I cannot think that low temperatures have been the chief cause of failure. A covering of snow is a great protection to the roots, but our beds at Ottawa have several times been exposed to temperatures many degrees below zero when entirely bare.

The seed of this clover is cheap, is easily obtained in all markets, and the value of the nitrogen collected by the plants, even if they live for only one year, will by far exceed the cost of the seed and all labour expended.

[Photo. by Frank T. Shutt.]

SHEEP FEEDING IN ALFALFA PASTURE, SECOND YEAR OF GROWTH. MAY 31, 1904.

[Photo. by Frank T. Shutt.]

CROP OF ALFALFA (TWO YEARS' GROWTH) BEING PLOUGHED UNDER, SHOWING EXTENSIVE ROOT SYSTEM. MAY 31, 1904.

S
133
.E22

GENERAL LIBRARY,
UNIV. OF MICH.
NOV 9 19[illegible]

DEPARTMENT OF AGRICULTURE
CENTRAL EXPERIMENTAL FARM
OTTAWA, - - CANADA

TREES AND SHRUBS

TESTED IN

MANITOBA AND THE NORTH-WEST TERRITORIES

BY

WILLIAM SAUNDERS, LL.D.
Director Dominion Experimental Farms

BULLETIN No. 47

JUNE, 1904

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE

To the Honourable

The Minister of Agriculture.

SIR,—I have now the pleasure of submitting for your approval Bulletin No. 47 of the Experimental Farm series on 'Trees and Shrubs tested in Manitoba and the North-west Territories,' which has been prepared by myself.

In this bulletin are given the results of a very large number of trials of trees and shrubs which have been planted at the Experimental Farms at Brandon, Manitoba, and at Indian Head in the North-west Territories, during the past sixteen years, to ascertain what species and varieties are hardy enough to endure winter in those parts of the Dominion. In the gathering of this information I have been ably assisted by Mr. S. A. Bedford, superintendent of the farm at Brandon and by Mr. Angus Mackay, superintendent of the farm at Indian Head, who have carefully planted and cared for the specimens and recorded the results of these tests from year to year. In my annual visits to these farms during the whole of this period I have also taken careful notes on the growth and relative hardiness of the many species under trial, and a summary of all the experience thus gained will be found in this bulletin.

The object in view in compiling this information is to present in a convenient and condensed form all the facts ascertained for the convenience and encouragement of those who desire to adorn their homes with these objects of beauty. The love of trees and shrubs is almost universal and nowhere is it more strongly felt than on the North-west plains where trees and shrubs are scarce. Until within the past few years large sums of money have been spent annually by settlers in the purchase of trees and shrubs from the East, many of which being too tender to endure the climate have perished the first winter. The information gained from the tests made at the experimental farms and published annually in the reports has greatly lessened this injudicious expenditure.

While this bulletin has been written mainly for the information of residents in the colder sections of Western Canada, it is hoped that it will also be of value to those living in the East, since any of the species found hardy enough to endure the climates in the North-west may be planted with assurance of success in any of the eastern parts of the Dominion.

I have the honour to be
Your obedient servant,

WM. SAUNDERS,
Director Experimental Farms.

Ottawa, June 29, 1904.

TREES AND SHRUBS

TESTED IN

MANITOBA AND THE NORTH-WEST TERRITORIES.

Sixteen years of experience have now been had in the testing of trees and shrubs at the Experimental Farms at Brandon,* Man., and at Indian Head in the North-west Territories. During this period a large number of species and varieties have been tried, and while many have proved tender, the number found hardy has been much larger than was at first anticipated. Much interest is felt in tree-planting on the plains, both for ornament and shelter, and improvement made by judicious planting of hardy species about a home is greatly appreciated. Much time and money have been wasted in the past in efforts to grow tender sorts, which do not survive the severe winters. The recommendations made in this bulletin as to hardy trees and shrubs, based on long experience, may be received with confidence. It is hoped that the information given will result in increased planting in cities, towns and rural districts, thus adding to the pleasures and attractions of home life throughout the great North-west country. Trees and shrubs which have been found hardy at the Experimental Farms at Brandon and Indian Head may be safely planted in almost all other parts of the Dominion.

ACER. MAPLE.

The maples form a very interesting and attractive group, consisting of many distinct species, both native and foreign, very few of which will endure the climate of the Canadian North-west. The well-known sugar, red and Norway maples, which succeed so well in the East, have been thoroughly tested both at Brandon and Indian Head by planting many hundreds of each sorts in successive seasons, both in sheltered and exposed situations, and after many years of experimenting scarcely a single specimen remains.

Acer dasycarpum, Ehrh. White or Silver Maple.

This is a native of eastern North America, is of very rapid growth and makes a shapely, rather open, tree. The leaves are silvery white on the under side. The wood is brittle and the branches are very apt to break when laden with ice in winter. This species is found growing further north than most of the other large growing maples.

Many hundreds of these trees grown from eastern seed have been planted on the western Experimental Farms during the past 15 years. Only a few have survived, and most of these are injured more or less every winter. Several specimens have, however, shown greater individual hardiness than others at Brandon, Man., where they have now reached a height of 20 to 25 feet. When seed can be obtained from these treees, young specimens can probably be grown of a hardier type. There are several silver maples growing well at Winnipeg, and at Portage la Prairie there is a group of fine specimens which were planted many years ago near the site of the

*Brandon is situated on the main line of the Canadian Pacific Railway, 133 miles west of Winnipeg, and has an altitude of 1,194 feet. Indian Head is in Eastern Assiniboia, 181 miles west of Brandon, also on the main line of the Canadian Pacific, and has an altitude of 1,924 feet.

old passenger station of the Canadian Pacific Railway. These trees have been watched for the past 12 years, and on no occasion has any winter-killing of the wood been detected. Some seed was obtained one season from these trees, but it did not germinate. Seedlings produced from seed ripened in Manitoba would probably be hardy in the North-west. The seed ripens early and falls from the trees about the middle of June. When gathered it should be allowed to dry for a few days, then sown about an inch deep in drills a foot apart. The seed germinates the same season, and the young seedlings usually attain a height of several inches before winter comes.

A. Negundo, L. Box Elder or Manitoba Maple.

This tree is found in many parts of Canada and the United States. It is a native of Manitoba and of portions of the North-west Territories, and when grown from seed ripened in the North-west this tree is perfectly hardy and is one of the most valuable and useful trees for that country. It is a rapid grower and succeeds well on all sorts of soil, provided the ground is not wet. Illustrations are given, in plate I., fig. 3, of a single tree grown at the Experimental Farm at Indian Head, of an avenue of the same, plate III., fig. 6, also at Indian Head, and of a hedge of Manitoba Maple, plate V., fig. 1, growing on the Experimental Farm at Brandon. This species is grown readily from seed which should be sown early in the spring, about an inch deep, in rows about a foot apart. If the ground is kept clean and the surface occasionally stirred with a hoe, the young trees make rapid growth and the strongest of them may be put out in permanent plantations the following season. Large quantities both of the seed and young trees have been distributed annually for many years past from the experimental farms to settlers in the Canadian North-west. Through this work plantations of these trees are now found on homesteads in almost every part of Manitoba and the Territories, which furnish shelter for the growing of garden vegetables, small fruits and flowers, as well as for buildings and stock. Such plantations make the dwellings of the settlers more attractive and home-like and in their shelter many other useful and ornamental shrubs may be successfully grown.

A. spicatun, L. Mountain Maple.

This species is found as far north as the Lake of the Woods, and if obtained from that locality and planted in sheltered spots should succeed in many parts of Manitoba and the Territories. Thus far, however, this shrubby species has not been successfully grown either at Brandon or Indian Head. Some 30 or 40 specimens have been planted on each of these farms, and they have usually had their wood killed back more or less every winter.

A. tataricum, L. Tartarian Maple.

This is a native of Eastern Europe. It is a small tree of slow growth that seldom exceeds from 12 to 20 feet in height, which as far as it has been tested, has proved quite hardy. A tree planted at Brandon in 1896 has never been injured by winter, and has borne seed each year since 1898. Seedlings grown from seed ripened on this tree have been planted both at Brandon and Indian Head and are entirely hardy.

A. tataricum Ginnala. Ginnalian Maple.

This is said to be a variety of the Tartarian Maple, and a native of Amurland, which has been extensively grown both at Brandon and Indian Head since 1891, and found to be thoroughly hardy. It is more shrubby in habit than the Tartarian Maple, seldom attaining a height of over 10 or 12 feet. The leaves are small and prettily cut or lobed. The wings of the seeds are early margined with bright red, and in the autumn the leaves assume brilliant hues of red and scarlet. This is undoubtedly one of the hardiest and most beautiful of shrubs, and is well adapted for general cultivation throughout the North-west country. It is easily raised from seed which is produced in abundance on comparatively young specimens.

The following species of maple have been thoroughly tested and found to be too tender to be grown in the Canadian North-west :—

A. campestre, L. Common European Maple, Europe.

A. circinnatum, Pursh. Vine Maple, British Columbia.

A. glabrum, T. & G. Smooth Maple, British Columbia.

A. Japonicum, Th. Japanese Maple, Japan.

A. monspessulanum, L. Montpellier Maple, Mediterranean region.

A. pennsylvanicum, L. Striped Maple, Eastern Canada.

A. platanoides, L. Norway Maple, Europe.

A. rubrum, L. Red or Swamp Maple, Eastern Canada.

A. saccharinum, Wang. Sugar Maple, Eastern Canada.

ÆSCULUS. Horse Chestnut, Buckeye.

The following species belonging to this group have been tried, but they have all proved too tender:—

Æsculus glabra, Willd. Ohio Buckeye, United States.

Æ. hippocastanum, L. Horse Chestnut. Europe.

Æ. pavia, L. Red Buckeye. United States.

AILANTUS. Tree of Heaven.

Ailantus glandulosa, Desf. Tree of Heaven, China. Tested both at Brandon and Indian Head, but has never survived the winter.

AKEBIA.

Akebia guinata, DC. China and Japan. This interesting climber has been tried, but is too tender.

ALNUS. Alder.

Among the alders there are one or two hardy species, but most of them are too tender to succeed in the North-west climate.

Alnus glutinosa. Common Alder, Europe and North Asia.

Specimens of this tree have done fairly well both at Brandon and Indian Head. Of those planted in 1889, 1890 and 1902 many have proved hardy and have grown well. This tree does not attain a large size. The foliage is glossy and rather handsome. Occasionally the wood will kill back a little in the winter, particularly in newly planted specimens, but usually the tree is quite hardy

A. viridis, DC. Green Alder. Northern Regions.

This, although a native shrub in the North-west, has not succeeded very well in cultivation. It was first planted at Brandon in 1890, and has generally been hardy

there. At Indian Head the wood has usually been more or less injured in winter, and sometimes it has been killed back as much as one-half.

The species and varieties of Alder which have on trial been found tender are :—

A. cordifolia, Ten. Heart-leaved Alder. South Europe.

A. glutinosa imperialis. Imperial Cut-leaved Alder.

A. incana, M. Speckled or Hoary Alder. Northern Temperate Regions.

A. incana laciniata. Cut-leaved Hoary Alder.

A. maritima, M. Seaside Alder. North America.

AMELANCHIER. June Berry.

Amelanchier alnifolia, Nutt. Alder-leaved June berry, Saskatoon berry, North-western America.

This is a native of Manitoba and the North-west Territories. It is a tall shrub, from 6 to 10 feet high, with a rather straggling habit. It produces a fruit much like that of the eastern shad bush, which is much prized both by the Indians and the settlers. The fruit is used in a fresh condition; it is also dried for winter use. This shrub grows fairly well in cultivation.

A. canadensis nana.

A dwarf variety of the eastern Amelanchier or shad bush. This shrub bears a good-sized edible fruit of fair quality, which has been tested for several years at Brandon and Indian Head, and has been killed back more or less every winter. The ordinary taller variety, so common in the woods in Eastern Canada, has not been tested sufficiently to permit of an opinion as to its hardiness, but it will probably be equally hardy with the dwarf form.

A. vulgaris, M.

The common service-berry of Europe has been tried for several years, but has not made satisfactory progress. It has been killed back more or less each winter.

AMORPHA. False Indigo.

Amorpha fruticosa, L. False Indigo.

This is a small shrub which bears very dark, bluish purple flowers in June. It is a native of Manitoba, and if raised from seed ripened in Manitoba will, in all probability, be hardy throughout the western country. This shrub, when grown from seed ripened in England when planted at Indian Head, has proved tender.

ARISTOLOCHIA. Birthwort.

Aristolochia sipho, L'Herit. Dutchman's Pipe. A native of the United States.

This has been tested at Brandon and Indian Head for the past four years and has killed back partly or wholly to the ground every winter. Where the roots prove hardy this climbing vine may be useful, as it makes a considerable and rapid growth each year. It has large and handsome foliage and curiously formed flowers much resembling a small tobacco pipe.

LILACS, SEEDLINGS OF CHARLES 10TH, AT BRANDON, MAN.

ARTEMISIA. SOUTHERNWOOD.

Artemisia abrotanum, L. Old Man, Southernwood.

This has been tested since 1890 both at Brandon and Indian Head. The wood has been killed back more or less each winter, much as it does in the East, but it always produces a luxuriant growth during the summer.

A. abrotanum tobolskianum. Russian Artemisia.

This is a taller and stronger growing variety than the 'Old Man' with a less pleasant odor. It has been tested for the past twelve years, the wood usually kills back in winter from one-third to one-half its length, otherwise it is quite hardy. It makes a strong and rapid growth in the spring. Cuttings of this shrub root readily in any moist soil and grow rapidly. At Indian Head a fairly good hedge has been grown in a single season from cuttings planted in the spring.

BERBERIS. BARBERRY.

The Barberries are a very useful class of shrubs, many of which are hardy or nearly hardy in most of the settled parts of the Canadian North-west. These shrubs bear their small greenish or yellow flowers singly or in bunches, which later in the season are followed by red or purple berries, which hang on the bushes all winter. The fruit may be made into a pleasant acid jelly. Fruits of the common barberry, *B. vulgaris,* are frequently offered for sale for this purpose, especially in the markets of the towns and cities of Quebec.

Berberis amurensis, Rupr. Amur Barberry, from Manchuria.

This variety was first planted in the Canadian North-west in 1898, and thus far has not suffered any material injury from winter. It resembles the common barberry, but seems to be somewhat hardier.

B. aristata, DC. Large Leaved Barberry, from Nepaul and the Himalayas.

This species has been tested for the past eight years, and while in some seasons it is killed more or less at the tips during the winter, it may be regarded as practically hardy. It has large leaves and yellow flowers.

B. Canadensis, Pursh. American Barberry.

This promises well, but has not been tested long enough to determine its hardiness.

B. Sieboldi, Miq. Siebold's Barberry. China and Japan.

Has been tested both at Brandon and Indian Head for the past five years, and while the tips of the branches have usually been killed back two or three inches each winter, it makes a growth so strong during the summer that the injury is scarcely noticed.

B. sinensis, Desf. Chinese Barberry. China and Japan.

This variety has been under trial in the North-west since 1894. At first it suffered from the killing of the tips in winter, but of late years it has been practically hardy.

B. Thunbergii, DC. Thunberg's Barberry. Japan.

While this species may be regarded as generally hardy, it suffers a little some seasons, usually only at the tips, but occasionally the branches are killed from one-third

to one-half their length. When this occurs, if the dead wood is cut out, the rapid growth of the bush soon makes it shapely again. This species has been under test at the western farms for eleven years. In this species the leaves are small, nearly round and without teeth on the margins. The flowers are borne singly under the stems, are of a greenish colour and are succeeded by scarlet berries. This shrub seldom exceeds three to four feet in height, and its neat box-like foliage, which assumes brilliant red tints in the autumn, followed by the bright scarlet berries which hang on the bush all winter, combine to make it attractive at all seasons of the year.

B. vulgaris, L. Common Barberry. Europe.

This has been under trial at the North-western farms for the past thirteen years. At first, and especially when planted in exposed situations, it was killed back considerably, but in recent years such injuries have been slight, and it may now be regarded as fairly hardy. This species has fruited in the North-west for several years past, and from the seed ripened there, seedlings are now growing, which are likely to prove entirely hardy.

B. vulgaris purpurea. Purple-leaved Barberry.

This handsome purple-leaved variety of the common barberry seems to be almost, if not quite, as hardy as the green-leaved form. It assumes its deepest shades of purple in the spring. It is almost hardy, especially when partly sheltered.

The following additional varieties are under trial, but most of them are too tender to be of much value:—

B. aquifolium, Pursh. Oregon Grape. Kills to ground.

B. aquifolium Murrayana. Kills to ground.

B. cretica, L. Cretan Barberry. Kills back considerably.

B. ilicifolia, Forst. Holly-leaved Barberry. Kills to near ground.

B. Neuberti. Kills to near ground.

B. virescens, Hook. Himalaya. Tender.

BETULA. Birch.

The birches are very graceful in their manner of growth, and among them there are several which are hardy in the North-west.

Betula alba, L. European White Birch. Northern Hemisphere.

This species has been under trial at the Brandon and Indian Head farms for the past 14 years, and its character for hardiness may now be considered as fairly established. Some of the trees early planted are now of good size. In the earlier plantings, which were mostly made without shelter, specimens were sometimes injured by winter, but no injury has been noticed for some years past.

B. alba laciniata pendula. Cut-leaved Birch.

This beautiful cut-leaved form of the European Birch is not so hardy as the common variety. Only a small proportion of the trees planted have survived, but these are now growing and seem to be hardy. This tree has a fine pendulous habit, its long slender branches like delicate streamers reach almost to the ground.

B. borealis.

This Birch is a native of Manitoba, and is found growing in a few localities along the Assiniboine river. The tree is small and the foliage is smaller than some other varieties of Birch; it grows well at Brandon, but is less thrifty at Indian Head.

B. lenta, L. Sweet Birch. North America.

This tree has been tested in the North-west for about ten years, and while some of the young trees planted have died, others have survived, and are growing nicely, with more or less killing back from year to year.

B. lutea, Michx. Yellow Birch. North America.

This variety has not succeeded quite so well as the Sweet Birch; a larger proportion of the young trees planted have been killed, and the survivors, although making fair growth, have been more or less injured. This tree somewhat resembles the Sweet Birch both in habit of growth and character of foliage.

B. papyrifera, Marsh. Paper or Canoe Birch. Canada, United States.

The Canoe Birch is a native of Manitoba, and has succeeded well in cultivation both at Brandon and Indian Head. A large number of young trees have been collected on the banks of the Souris river, Man., and distributed from the Brandon farm among the farmers of Manitoba for test, with good results.

B. pumila, L. Low or Dwarf Birch. North America.

This species is found native both in Manitoba and the Territories, and where the soil is fairly moist it succeeds well when transplanted. It makes a pretty low-growing tree or bush, with its small foliage and twigs dotted with white. It is quite hardy.

Among other varieties of birch which have been tested and found more or less tender are the following :—

B. alba fastigiata. Pyramidal Birch.

B. alba pendula Youngi. Young's Weeping Birch.

B. alba pendula elegans. Elegant Weeping Birch.

B. alba purpurea. Purple Birch.

B. davurica, Pall., from North Asia.

B. nigra, L. River Birch. United States.

B. occidentalis, Hook. Canyon Birch. British Columbia.

B. populifolia, Marsh. American White Birch.

CARAGANA. Siberian Pea Tree.

Of all the shrubs which have been brought from other countries to the Canadian North-west none have been so uniformly hardy under all circumstances as the species of Caragana, all of which as far as they have been tested have proved perfectly hardy. They are handsome shrubs, with beautiful foliage and pretty yellow pea-shaped flowers in the spring followed by small brownish pods which give an abundance of seed. The different species are readily grown from seed which should be sown in the

autumn or early in the spring. If well cared for the young seedlings grow rapidly and produce strong plants the first season, which will be ready to plant in position the year following.

Caragana arborescens, Lam. Siberian Pea Tree. Siberia.

This is a large shrub or small tree growing when mature from 12 to 15 feet in height. It has been thoroughly tested in many parts of the North-west during the past fifteen years and is reported everywhere as hardy, in exposed as well as in sheltered positions. It has been widely distributed from the experimental farms among thousand of settlers and is proving very useful when planted either as single specimens or as hedges.

C. Chamlagu, Lam. From China and Japan.

This is a smaller growing species ranging from three to four feet in height. It has been under trial for the past four years, and has shown no evidence of winter killing.

C. frutescens, DC. Woody Caragana. Russia to Japan.

A very pretty shrub rarely exceeding three to four feet in height, handsome both in foliage and flower. The leaves are compound in all the Caraganas, in *C. arborescens* they consist of four to six pairs of leaflets, whereas in this species there are only two pairs. This has been tested for the past twelve years and has proved hardy.

C. frutescens pendula. Pendulous Woody Caragana.

This differs from the ordinary form of the Woody Caragana in its more graceful habit and weeping character. It is also quite hardy.

C. frutescens mollis glabra.

Another form of the Woody Caragana which has been found quite hardy at the North-western farms.

C. grandiflora, DC. Large-flowered Caragana. Region of the Caspian Sea.

This also is one of the lower growing species of Caragana, seldom exceeding a height of four or five feet. It is distinguished from the other sorts by its unusually large, bright yellow flowers which give it a handsome appearance in the spring. This also has been under trial for about 12 years, and has never been injured by winter.

C. pygmaea, DC. Dwarf Caragana. Caucasus to Himalaya.

The Dwarf Caragana is a very low growing form, from 1½ to 3 feet in height, with very small foliage and small flowers. It makes a very pretty bush and is attractive all through the season. It is quite hardy.

CARPINUS. Hornbeam.

Carpinus, caroliniana, Walt. (= *C. americana,* Mich.). Blue Beech or American Hornbeam. North America.

This has been several times tried at both Brandon and Indian Head, but the trees have been invariably killed back, usually to the ground every winter, and in the course of three or four years have died.

CARYA. Hickory.

Carya alba, Nutt. Shagbark Hickory. North America.

This tree has been thoroughly tested at both the North-west farms, and has invariably died the first winter after planting.

CASTANEA. Chestnut.

Castanea dentata, Borkh. American Chestnut. North America.

C. sativa, Mill. European Chestnut. South Europe.

Both of these varieties of Chestnuts have been tried and found too tender, none of the young trees having survived the winter.

CATALPA.

Catalpa cordifolia, Jaume. Western Catalpa. Western Kentucky and Tennessee.

C. hybrida, (Teas') Teas' Hybrid Catalpa.

C. Kaempferi, S. & Z. Japanese Catalpa. Japan.

Many young trees of each of these species have been planted at the North-west farms, but in no instance have they survived the winter.

CELASTRUS. Bittersweet.

Celastrus articulatus, Thunb. Japanese Bittersweet.

This climber has been under trial during the past five years, and while most of the specimens planted have been killed back more or less during the winter, they have been found quite hardy near the base, and have made good growth during the summer. It is quite probable that this species may, after a time, become acclimated and useful.

C. scandens, L. Climbing Bittersweet. North America.

This is a handsome climber which is found growing wild in some parts of Manitoba, and is common in the neighbourhood of Birdshill, a few miles east of Winnipeg It has been found quite hardy at Brandon, and although some specimens have killed back more or less at Indian Head, it may be regarded as practically hardy there also. It is of sturdy habit and bears small greenish flowers, which are succeeded by clusters of orange-coloured berries.

CELTIS. Hackberry.

Celtis occidentalis, L. Hackberry. North America.

Although this tree is found growing wild in some parts of Minnesota, it has not been entirely hardy in the Canadian North-west. At Brandon it has been tested for the past five years, and while some specimens have passed the winters uninjured, others have been killed back, some at the tips only, others as much as one-half their height. At Indian Head the specimens under test have been killed to near the ground. Further trials are being made with specimens grown from seed collected in Minnesota. The foliage of this tree is very susceptible to frost.

CEPHALANTHUS. Button Bush.

Cephalanthus occidentalis. Button Bush. North America.

This interesting shrub, so hardy throughout the eastern part of Ontario, is tender both at Brandon and Indian Head, and is usually killed to the ground each winter.

CERCIDIPHYLLUM.

Cercidiphyllum Japonicum, S. & Z. Katsura Tree. Japan.

This is a valuable timber tree in Northern Japan, which has proved hardy in Ottawa. It is, however, tender in the North-west, and has never survived a winter.

CLEMATIS. Virgin's Bower.

In this group, which consists largely of climbing vines, there are several which are hardy and useful in the Canadian North-west.

Clematis ligusticifolia, Nutt. Western Canada and United States.

This species is found growing wild in river valleys in Alberta, also through the dry districts of central British Columbia. It is a strong growing climber, and is well adapted for the adornment of porches and verandahs. It is quite hardy at Brandon and Indian Head, and has been grown successfully for some years as an ornamental climber at Calgary. The flowers are small and white, and are produced in abundance, and in seed the vines are quite ornamental, being covered with masses of silky material made up of the feathery tails which spring from the base of the seeds.

C. recta, L. Erect Clematis.

This may be more correctly classed as a herbaceous perrenial than a shrub. It may, however, be more convenient to treat of it here. This Clematis dies to the ground every year, and sends up strong shoots in spring, which grow to a height of about three feet, when their tips become covered with masses of white sweet scented flowers. This has proved hardy both at Brandon and Indian Head, and if protected in winter by a mulch of manure or straw, would probably succeed in any part of the North-west.

C. virginiana, L. Virgin's Bower. Canada, United States.

This native eastern species, which is highly ornamental when in bloom, has been tried with some success at the North-western farms. The wood is not entirely hardy, and is usually killed back more or less in winter, but it makes a vigorous growth from near the ground and blossoms freely during the summer. The flowers are small, white and fragrant, and the masses of silky seed tails which cover the vine in the autumn gives it an attractive appearance at that season also.

C. vitalba, L. Traveller's Joy. Europe.

The wood of this vine has also been more or less killed by winter in the North-west, but as it sends up in spring strong shoots from near the base which grow very rapidly, the partial winter killing to which it is subject does not much lessen its value. In this species the flowers are white with a sweet almond scent, but the vine is about two weeks later in blooming than the Virgin's Bower.

C. viticella, L. Vine Bower. Europe.

In this species the flowers are larger and drooping and vary in colour from a pale purple to a dull blue, and occasionally are of a dull rose colour. The wood of this vine is also more or less injured by winter, but the base of the plant and the roots are hardy, the growth in summer is rapid and it sometimes blooms freely before the season is far advanced.

C. paniculata, Thunb. Japan.

C. montana, Wall. Mountain Clematis. Himalaya.

Both these species have been tried, but they are too tender to endure the climate.

COLUTEA.

Colutea arborescens, L. Bladder Senna. Mediterranean region.

This shrub, which is rather tender at Ottawa, has been tried in the North-west, but has invariably died the following winter.

CORNUS. Dogwood.

Among the many varieties of Dogwood in cultivation there are several which succeed well in the North-west.

Cornus alba sibirica, L.C. Siberian Dogwood.

This is a rather handsome shrub, with good foliage and numerous clusters of small white flowers during the summer, succeeded by white or lead coloured berries. The branches and twigs of this shrub, which in summer are greenish or dull reddish, assume a brilliant red colour during the winter which forms a striking contrast with the pure white snow. This has been tested for the past seven years at both the western farms and found to be hardy.

C. alba sibirica variegata. Variegated Siberian Dogwood.

This is a form of the Siberian Dogwood with very pretty variegated leaves, which are blotched and striped with silver. This shrub has not proved entirely hardy, the summer growth has been rather feeble and the wood has usually winter killed to the extent of one-half and sometimes it has been killed to the ground.

C. Baileyi, C. & E. North America.

In foliage and habit this variety resembles the Siberian Dogwood. It has not, however, shown itself quite so hardy. The wood has usually been winter killed at the tips, but not to a sufficient extent to interfere with its value as an ornamental object in the shrubbery border.

C. stolonifera, Michx. Red Osier Dogwood. North America.

This shrub is found native in Manitoba and the North-west Territories where it grows freely in ravines and coulées. Its foliage is good and its form attractive. The flowers are white and borne in flat clusters, succeeded by white berries. A very nice hedge may be made of this shrub by growing young plants in the garden from the seeds in the berries and planting them out when two years old in a single row a foot apart. They may also be transplanted from the woods. In this species the branches also became quite red in the winter, but they do not assume as brilliant a colour as those of the Siberian Dogwood.

The varieties of Cornus which have been tried at the North-west farms and found tender are :—

C. alba sibirica elegantissima.

C. alba sibirica Spæthii. Golden-leaved Dogwood. See Plate III., fig. 1.

C. amomum, Mill. Known also as *C. sericea,* L. North America.

C. sanguinea, L. Red-Branched Dogwood. Europe.

The two first named have usually killed outright the first winter, while the two latter have generally had their wood killed back one-half, and frequently to near the ground.

CORYLUS. Hazel Nut.

The two species of wild hazel nut found in Eastern Canada grow plentifully in Manitoba and the Territories, and when young bushes are transplanted to the shrubbery or grown from nuts they make very shapely specimens.

Corylus americana, Walt. Common Hazel Nut. North America.

This is much the commonest species, and is found in abundance in many parts of the North-west. In this species the nut is not entirely covered by the husk, but shows through at the tip.

C. rostrata, Ait. Beaked Hazel Nut. North America.

In this species the husk or covering of the nut is much longer, and not only entirely covers the nut, but extends considerably beyond it, becoming beak-shaped at the tip. Both these species are quite hardy in most parts of the North-west.

COTONEASTER.

The Cotoneasters are handsome shrubs, of which quite a number are being tested. Three of these appear to be quite hardy, both at Brandon and Indian Head.

Cotoneaster acutifolia, Turcz. Sharp-leaved Cotoneaster. Mongolia.

This has been under trial at the North-west farms for six years, and only once during this period, in 1900, has it been at all injured by winter, and then it was only killed slightly at the tips. The bush is compact in form and the leaves glossy and pointed. It blooms freely in the spring, but the flowers are small; later in the season the bush is ornamented with black berries.

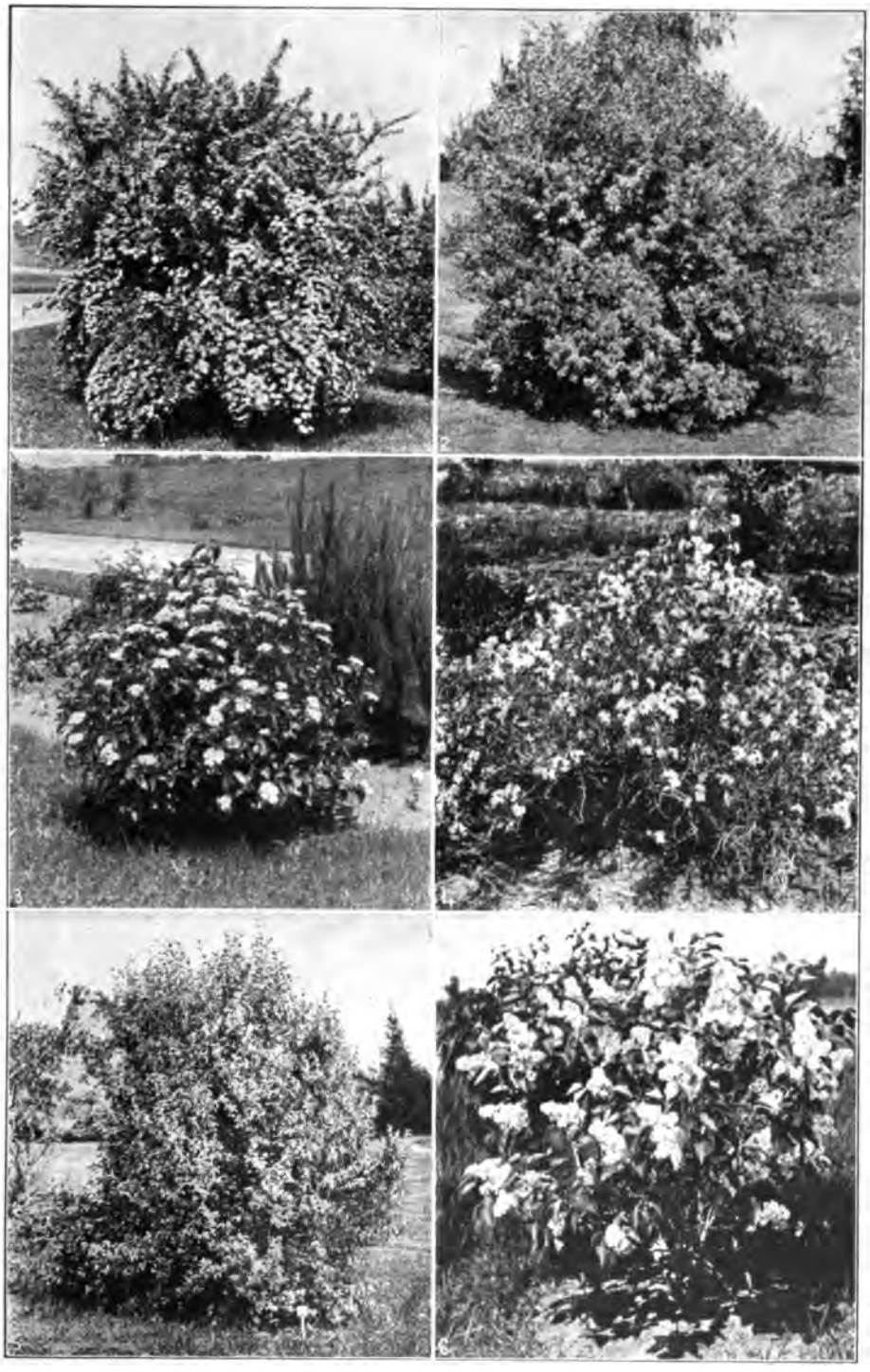
C. integerrima, Medic. Common Cotoneaster. Mountains of Europe.

This has been under trial for the past seven years, and has proved entirely hardy. In this species the leaves are more rounded and less glossy; the bush is also more open in habit. The flowers are small, but the berries are red; they are produced in abundance and hang on the bushes all winter.

C. tomentosa, Lindl. Alps.

In this species the leaves are downy on the underside; they are pointed but not glossy. The bush has an upright habit of growth, and the berries are bright red.

These shrubs are not only ornamental when grown singly, they also make very nice hedges. For this purpose the young bushes two years from seed should be planted a foot apart and trimmed once or twice a year to make the growth compact



[Photos. by C. E. Saunders.]

1.—SPIRAEA VAN HOUTTE.
2.—LONICERA TATARICA ALBA.
3.—VIBURNUM DENTATUM.
4.—LONICERA ALBERTI.
5.—ELAEAGNUS ARGENTEA.
6.—SYRINGA VULGARIS DR. MAILLOT.

They are all easily grown from seed, but frequently the seed does not germinate until the second season after sowing.

CRATÆGUS. Hawthorn.

There are several species of thorn which have proved useful additions to the collections of shrubs at the North-west farms, as they are both attractive and hardy.

Cratægus chlorosarca, Maxim. Manchuria.

This thorn is also known under the name of *C. sanguinea Schroederi.* It bears pinkish white clusters of blossom in spring, and is very handsome when in bloom. Its red berries in the autumn are also ornamental. This species has been under trial for the past six or seven years, and although it has on one or two occasions been slightly injured in winter at the tips, it may be regarded as practically hardy.

C. coccinea, L. Scarlet Haw. Canada, Eastern States.

This handsome species, so common in fields in the East, is also found native in Manitoba, and its white clusters of bloom in the spring and later its bright scarlet fruit, are frequently seen in the coulées and ravines where native shrubs find shelter. It is found from Winnipeg to near the Rocky Mountains. At both the western farms this has been tested in cultivation and found quite hardy.

C. oxyacantha sibirica. Siberia.

This is a Siberian form of the English hawthorn, which has been under trial for five years. At Indian Head there are specimens from five to six feet high which have made strong growth and been quite hardy. At Brandon the specimens are somewhat smaller, but they have wintered equally well.

C. sanguinea, Pall. Siberia.

This species has also stood the North-west winters well for the past five or six years. It has grown quite vigorously at Brandon, and some specimens have attained a height of four feet at Indian Head.

There are several other species of thorn under trial, some of which will probably prove hardy. The common English hawthorn, also the double red and double white varieties have been tried but these are all too tender for that climate.

CYTISUS. Broom.

In this interesting family of low growing and free blooming shrubs there are several species quite useful for cultivation in the North-west. While their wood is not entirely hardy it is usually hardy towards the base and the roots pass the winter uninjured. In the spring rapid growth takes place from those parts of the branches which have escaped injury, the bush soon assumes a shapely form, and is covered with flowers later in the season.

Cytisus capitatus, Jacq. Europe.

Quite a number of specimens of this species are now growing both at Brandon and Indian Head. A seven years' trial has shown that they are usually killed at the tips, and sometimes to the extent of one-half. Occasionally they are killed to the ground, but they make new growth from the base and the bushes are covered with their yellow pea-shaped blooms before the season is over.

C. purpureus, Scop. European Alps.

In this species the flowers are purple and are borne in abundance. Although this is probably not quite so hardy as *C. capitatus,* it makes a very handsome bush when in flower, and although it may be killed to the ground in the spring, it usually flowers well later in the season.

The following species have also been under trial for several years, and although they appear to be somewhat less hardy than those above named they may serve a useful purpose, especially in sheltered spots :—

C. hirsutus, L.

C. nigricans longispicatus.

C. sessilifolius, L. These all have yellow flowers.

DEUTZIA.

The Deutzias are very beautiful shrubs, especially when in bloom, but unfortunately none of them are hardy enough to endure the winter in the North-west. The following species have been thoroughly tested and they have all been winter killed. Most of the Deutzias have been brought from Japan or China.

Deutzia gracilis. S. & Z.

Deutzia gracilis variegata.

Deutzia Fortunei.

Deutzia hybrida Wellsii.

DIERVILLA. Weigelia.

The Weigelias also are mostly Japanese shrubs which have seldom proved entirely hardy at Ottawa. One of the hardiest varieties in the East is *D. florida Sieboldii,* but this on trial has been found too tender for the North-west.

There is a native species of Diervilla, which although much less beautiful than the Weigelias is well worthy of cultivation.

Diervilla Lonicera, Mill, also known as *D. trifida.*

This species is reported by Macoun to be a common native shrub from the island of Anticosti in the east to the Red Deer River in the North-west. It is found 'in dry, rocky fields, along fences in dry thickets, and also along the gravelly banks of rivers.' The specimens tried in the North-west have been nursery grown and imported from Europe. These have proved hardy in some instances, but in others they have been killed back one-half and sometimes to the ground. They make, however, a vigorous growth from the roots and produce their yellow flowers in terminal clusters later in the season. If this shrub were grown from seed produced in the North-west, it would in all probability be entirely hardy in cultivation.

ELÆAGNUS. Olive.

The shrubs or small trees belonging to this genus are very ornamental. The foliage and fruit is of a silvery white—the flowers are small and yellow, fragrant, and produced in great abundance.

Elæagnus angustifolia, L. Russian Olive. Europe.

The ordinary European form of this tree comes from the Mediterranean region and the Orient. Obtained from these sources, this shrub is usually tender in the North-west, but there is a hardy form, apparently of the same species, which has been brought from the northern parts of Russia, and specimens obtained from that source are quite hardy in the Canadian North-west.

Many of the specimens tested at Brandon and Indian Head were grown from seed ripened at the Experiment Station, Brookings, South Dakota. These have made satisfactory growth and are quite hardy. The Russian Olive can also be grown from cuttings, just as currants are grown, from short pieces of the wood of the previous year.

E. argentea, Pursh. Wolf Willow, Silver Berry. North America.

This pretty shrub is found in great abundance in many parts of Manitoba and the North-west Territories. In its wild state it is usually of small growth, has a straggling habit and sends up suckers freely. It frequently grows in large patches, which when in bloom in the spring fill the air with their fragrance. In cultivation, it makes a bushy and handsome specimen, (see Plate II, fig. 5) which with its shining silvery foliage is a striking object on a lawn. It has, however, the objectionable habit of suckering. For this reason, it is not suitable for a cultivated border, but on a grassy lawn the underground roots can seldom force their shoots through the sod. This shrub is entirely hardy in cultivation.

The following species have been tried and found too tender :—

E. macrophylla, Thunb. China and Japan.

E. multiflora, Thunb. China and Japan. This latter species is also known as *Elæagnus edulis.*

EUONYMUS. Spindle Tree.

Most of the species forming this group are shrubs which bear small greenish flowers in the spring, succeeded later by scarlet berries. None of the species yet tested are entirely hardy in the Canadian North-west.

Euonymus atropurpureus, Jacq. Burning Bush.

This species, which is a native in western Ontario, has been tried for the past seven or eight years both at Brandon and Indian Head. In every instance the wood has been killed back more or less in winter, sometimes one-half and occasionally to near the ground. Under such disadvantages this shrub does not make much progress.

E. europæus, L. Common Spindle Tree. Europe.

The European Euonymus has also been tried with similar results, the proportion of winter-killing usually ranging from one-half to three-fourths. A Russian form of the European species which was introduced many years ago by Prof. J. L. Budd, of Iowa, under the name of Russian Euonymus seems to be no hardier in the Canadian North-west than the ordinary form.

E. nanus obovatus.

This is a species from the Northern Caucasus, which has been tried, but found no hardier than the two previously referred to.

E. linearis is also under test, but has not been grown long enough to determine its position as to hardiness.

EXOCHORDA.

Exochorda grandiflora, Lindl. China.

This shrub, which makes such a handsome and free flowering specimen in the Niagara district in Ontario, has been tested at Brandon, but has never survived a winter.

FAGUS. Beech

Neither the American nor European beech has been found hardy enough to endure the winters in the North-west country. Both have been tried several times during the past twelve years, but in no instance have they survived a winter.

FRAXINUS. Ash.

Fraxinus americanus, L. White Ash. North America.

The limits of distribution of this species in Canada is given by Macoun as from Cape Breton, N.S., in the east, to Owen Sound, Ont., in the west. Several hundred specimens of white ash trees of different ages have been tried during the past fourteen years both at Brandon and Indian Head, and a very large proportion of them have gradually died from successive winter killing. The few survivors appear now to be almost hardy, occasionally specimens will be killed back more or less, while in other seasons they appear to pass the winter uninjured.

F. pennsylvanica, Marsh. Red Ash. North America.

This species is found native in Canada over a very large area, extending from Halifax, Nova Scotia, to the Red Deer River at the head of Lake Winnipegosis, Lat. 53. The red ash has been planted in considerable numbers at both the western farms, the young trees sent there having been grown in the east. A large proportion have lived, and when once well established they appear to be quite hardy. If grown from seed ripened in the North-west they would no doubt be hardy from the beginning. If the branches of this tree are trimmed up so as to expose the bark of the trunk to the action of the sun, it is liable to sunscald, which sometimes seriously interferes with its growth.

F. pennsylvanica lanceolata, Sargent. Green Ash.

The green ash is also a very widely distributed species. It is common from Ontario to Fort Ellice in the North-west Territories, and is specially abundant in river valleys. It closely resembles the red ash, and both sorts are readily grown from seed. Large quantities of these trees have been grown at the western experimental farms from seed collected in the river valleys in the Territories. They have been grown to form wind breaks on the farms, and have been distributed in large numbers among farmers. All the trees from this source have been found quite hardy ; they are, however, slow growers.

F. nigra, Marsh. Black Ash. Canada, United States.

The black ash is found native in Canada from Anticosti to Fort William on the western side of Lake Superior, also on the Nepigon river and on the east side of Nepigon Lake. Young trees of this species have been repeatedly sent from Ontario to the western experimental farms, but only a small proportion of them have survived. Some which have lived through several winters have gradually reached a fair degree of hardiness. Much better success has been had with young trees brought from Fort Wiliam on Lake Superior, such trees have been quite hardy both at Brandon and Indian Head, and are making very fair growth.

The following species of ash have also been tried, but have been found too tender for the North-west climate :—

F. longicuspis, S. & Z. Japan.

F. quadrangulata, Michx. Blue Ash. Western Ontario and United States.

GENISTA. Greenwood.

None of the members of this family have been found hardy in the North-west. *Genista tinctoria,* Dyers' Green Weed, has been tried several times, but has never survived a winter. In 1900 a Siberian form, *G. tinctoria sibirica,* was obtained and forwarded for test. This variety has thus far proved hardy at the roots, but the young shrubs have been killed to the ground each winter.

GLEDITSCHIA. Honey Locust.

Gledischia triacanthos, L. Honey Locust, North America.

This tree which has been so much used as a hedge plant in western Ontario, is not hardy enough to endure the climate of Manitoba or the Territories. Sometimes newly planted specimens in sheltered spots, and small enough to be covered by snow in winter, have survived for a season, but these have usually died the following year.

GYMNOCLADUS.

Gymnocladus Canadensis. Kentucky Coffee Tree. North America.

Several hundred specimens of this tree have been tried at both the western farms under varying conditions. A very large proportion of them have died the first winter. A few have survived for a year or two, making a short stunted growth in the summer which would be killed back during the winter.

The following shrubs have been tested and found too tender for the North-west climate :—

Hamamelis virginica, L. Witch Hazel. Eastern North America.

Hippophæ rhamnoides, L. Sea Buckthorn. Europe.

Hypericum calycinum, L. Large calyxed St. John's Wort. Europe.

H. hircinum, L. Goat-scented St. John's Wort. Mediterranean region.

HUMULUS LUPULUS, L. Hop.

The Hop is a hardy native, which makes a good climber to form shelter on a trellis, or covering for the lattice work of a verandah. It has been tried both at Brandon and Indian Head and found hardy. The European sorts of hops have also proved hardy at these farms

HYDRANGEA.

Hydrangea paniculata grandiflora, S. & Z. Japanese Hydrangea.

The Japanese Hydrangea has been repeatedly tried at both the western farms, and although it sometimes survives the winter, it is frequently killed back, and sometimes to the ground. It is a very free blooming shrub, and when it does survive it

always makes an effort to flower, but any flowers yet seen in the North-west on this shrub have been small and puny when compared with the large clusters of bloom grown in the east. This shrub succeeds best in a moist climate, and the North-west air is dry; under such circumstances, vigorous growth can scarcely be expected. By providing careful shelter for the winter and giving a good deal of attention in the way of watering during the summer, the Japanese Hydrangea may very probably be induced to grow and bloom, but without such care success is very doubtful.

JUGLANS.

Juglans cinerea, L. Butternut. North America.

Juglans nigra, L. Black Walnut. North America.

The Butternut and Black Walnut have both been thoroughly tested at Brandon and Indian Head, many hundreds of young trees having been planted under varied conditions as to shelter. As a rule, they have all perished the first winter. Under exceptional conditions as to shelter, an occasional specimen will sometimes survive for one or two seasons, but in such cases the growth is very stunted and the new wood is usually killed back every winter to near the ground.

LIGUSTRUM. Privet.

As a class the privets are too tender to succeed in the North-west; there is one variety, however, which is hardier than the others, with which partial success has been obtained. This is known as the Amur Privet *Ligustrum amurense,* Carr., which comes from the Amur region. Some seasons this seems to be hardy, while at other times the tips of the bushes will be killed, and occasionally the winter-killing will extend half way or more to the ground. At Brandon it has been tried as a hedge and while some specimens have had their wood more or less killed, others alongside have been uninjured.

The more tender sorts which have been tried are the following, and none of them have survived:—

Ligustrum sinense, Lour. Chinese Privet. China.

L. vulgare, L. Common Privet. Europe.

L. vulgare fol. aureis, Var. Golden Privet.

LONICERA. Honeysuckle.

The Honeysuckle group includes some climbers, with a large number of bush varieties, and most of the bush forms are very hardy and well adapted for cultivation in the North-west country. They flower very freely in the early spring, and the flowers vary in tint from pure white through different shades of rose to red. They also vary much in size and are succeeded by berries most of which are red.

Lonicera spinosa, Jacq., var. *Albertii.* Albert Regel's Honeysuckle. Eastern Turkestan and Siberia.

This is a low growing bush with narrow leaves and fragrant flowers of a dull rose colour. It has been tested at Indian Head for twelve years and has shown itself always very hardy. It is a most desirable shrub, (see Plate II, fig. 4) which blooms during the latter part of June.

L. bella atrorosea. A medium-sized bush, very free flowering, flowers rosy. Hardy.

L. flava, Sims.—Another of the bush forms of medium size with yellow flowers.

L. gracilipes, Miq. Japan. A shrubby form of small size, with pink flowers and small leaves. Hardy.

L. glauca, Hill. A glaucous-leaved climbing honeysuckle found in the United States and Canada, a climber with yellow flowers. This species is quite ornamental and very hardy.

L. hirsuta, Eaton. Hairy Honeysuckle. A bushy shrub with orange yellow flowers found in Canada and the United States. Hardy.

Lonicera Maacki, Herd. Maack's Bush Honeysuckle is a pretty species and a very hardy form. This is a native of Manchuria, is a very free bloomer and the flowers are white.

L. Morrowi, A. Gray. Japan. A shrubby species which bears white, or yellowish white flowers in great profusion. Hardy.

L. oblongifolia, Hook. North America. A native species found in different parts of Manitoba. Hardy.

L. Sibirica. Another hardy bush form ; a free bloomer and desirable.

L. ruprechtiana, Regel. A bush honeysuckle from Manchuria, with white or yellowish white flowers.

L. tatarica, L. Tartarian Honeysuckle.

L. tatarica alba. (See Plate II, fig. 2.)

L. tatarica elegans.

L. tatarica grandiflora.

L. tatarica splendens.

These are all large growing shrubby forms of honeysuckle, originally from Siberia, which are very ornamental. They flower profusely in the early spring and the flowers vary in size in the different forms, they also vary in colour from white, through shades of rose to red, and are very hardy.

L. Xylosteum, L. Upright Fly Honeysuckle is a hardy European sort, with small creamy white flowers.

Among the varieties of honeysuckle which have been tested and found tender in the North-west are *L. periclymenum,* the fragrant English Honeysuckle, and *L. sempervirens,* the Scarlet Trumpet Honeysuckle, both very desirable climbers. These have been tried several times at both the North-west farms, but have not survived.

LYCIUM. Matrimony Vine.

Lycium Chinense, Mill. Chinese Matrimony Vine, China.

This is a robust growing woody vine which sends up new shoots from the base every year which grow to a height of 6 or 8 feet, and bear along the greater part of their length purple flowers followed by brilliant red berries which adorn the vines until winter. Although they are liable to kill to near the ground in winter in the North-west, they send up vigorous shoots in the spring which flower and fruit well during the summer.

L. europæum, L. Matrimony Vine. Mediterranean region.

The European Matrimony Vine resembles the Chinese much in its habit of growth, its flowers are violet coloured, and the fruit which is smaller than that of the Chinese species, is bright scarlet. Well established plants in good soil will often make shoots 8 or 10 feet long in a single season. If grown in the shrubbery border or singly on the lawn they should be tied to a central stake, and the branches allowed to droop from this to the ground.

MENISPERMUM. Moonseed.

Menispermum canadense, L. Canadian Moonseed. North America.

The Canadian Moonseed is a woody climber which in the North-west is usually killed to the ground in winter, but sends up shoots from the base in the spring which grow rapidly and attain a considerable height before the season closes. The roots are thick and woody, the flowers small, greenish yellow.

M. Dauricum, DC. Siberia and China.

This is another member of the same family; it closely resembles the Canadian species, but is perhaps somewhat hardier.

MORUS. Mulberry.

The only species of mulberry likely to succeed in the Canadian North-west is the Russian Mulberry *Morus hybridum.* This has been thoroughly tested both at Brandon and Indian Head, and has failed owing to lack of hardiness.

NEILLIA. Ninebark.

Neillia opulifolia, B. & H. Ninebark. North America.

This was formerly grouped with the Spiræas and known as *Spiræa opulifolia.* It is native in the western part of Ontario, and in the North-west is usually found to be quite hardy. It forms a very shapely shrub which produces in the spring clusters of small white flowers, succeeded by purplish seed pods. In fourteen years 'trial at Brandon it has only once suffered from winter, that was in 1900, when the wood was killed back from one-quarter to one-half its length. At Indian Head it has been tested for the same period and has also been quite hardy except in 1900, when it was killed back about one-half.

N. opulifolia aurea. Golden-leaved Ninebark.

This is a golden-leaved variety, which is very handsome and attractive, especially in the spring when its golden hue is brightest; later in the season the golden tint fades more or less, becoming yellowish green. This seems to be quite as hardy as the ordinary green form. Both sorts have been tried for many years and have never been injured by winter except in 1900.

OSTRYA. Hop Hornbeam, Ironwood.

Ostrya virginica, Willd. Ironwood. North America.

The Ironwood is found in many parts of Eastern Canada and the United States, extending as far west as Minnesota. Many specimens grown in the east have been

[Photos. by C. E. Saunders.]

1.—GOLDEN LEAVED DOGWOOD.
2.—WHITE SPRUCE HEDGE, BRANDON.
3.—SUPERINTENDENT'S HOUSE AND BARN, BRANDON.
4.—SALIX BRITZENSIS HEDGE, BRANDON.
5.—AVENUE, DAKOTA COTTONWOOD, INDIAN HEAD.
6.—AVENUE, MANITOBA MAPLE, INDIAN HEAD.

planted both at Brandon and Indian Head, and they have usually been killed back more or less every winter, sometimes at the tips only, at other times half way or to near the base, and occasionally they have been injured so much as to cause their death. Some young trees grown from seed ripened in Minnesota have proved considerably hardier and have come through the past three or four winters, almost uninjured. Young trees grown from eastern seed are too tender for the North-west climate, but if grown from seed ripened in Minnesota it is probable that they will, as a rule, prove fairly hardy in sheltered situations.

PERIPLOCA.

Periploca græca, L. The Greek Periploca. South-eastern Europe.

This is a deciduous twining woody vine found in many parts of Europe. It has been tested in the North-west for the past five years, and although it is killed to the ground each winter, it usually makes a fair growth of young shoots during the summer. The foliage of this vine is handsome, the leaves being ovate in form and from three to four inches in length.

PHILADELPHUS. Mock Orange.

These shrubs are also known under the name of Sweet Syringa, although the term Syringa properly belongs to the Lilac. There are many different sorts of Mock Orange or Philadelphus, all of which produce in spring white flowers in great abundance. Some of these have a strong perfume resembling that of the orange blossom, while others are almost odorless. When in bloom these shrubs are quite an ornament in the shrubbery border. In the North-west they are all too tender to be grown with success, unless the branches are bent down and well covered with soil; without such protection they very seldom produce any flowers. Some seasons the wood is killed to the extent of one-third to one-half; at other times it is killed to the ground. The roots, however, are hardy, and strong shoots are sent up in the spring which make good growth during the summer.

During the winter of 1901-2 two of the varieties under test, which are probably a little hardier than the other forms, passed through the winter at Brandon with less than the usual amount of injury and *P. deutziaeflorus* and *P. grandiflorus* each produced for the first time a few flowers. By giving these shrubs the protection referred to by covering them with soil or by wrapping with straw or covering with a box, they may be so far preserved as to admit of their flowering to some extent. Most of the varieties have been under test for from six to sixteen years.

The following are the sorts which have been under trial:—

Philadelphus cordifolius, Lange. Heart-leaved Philadelphus.

P. coronarius, L. Mock Orange. Asia.

P. coronarius foliis aureis. Golden-leaved Mock Orange.

P. coronarius nana. Dwarf Mock Orange.

P. deutziæflorus. Deutzia-flowered Philadelphus.

P. gordonianus, Lindl. British Columbia. Western United States.

P. grandiflorus, Willd. Large-flowered Philadelphus. Southern United States.

P. hirsutus, Nutt. Oregon.

P. hybridus Lemoinei. Boule d'Argent.

P. inodorus speciosus grandiflorus.

P. Ketelerii, fl. pl. Double flowered Philadelphus.

P. Satsumi, Siebold. Japan.

PLATANUS.

Platanus occidentalis, L. American Plane Tree, Buttonwood.

This beautiful tree, which succeeds so well in Eastern Ontario, will not endure the climate of the North-west. Some hundreds of specimens have been planted at the two western farms, under different conditions as to shelter, but none of them have ever survived the winter.

POPULUS. Poplar.

The poplars are a most useful family of trees in the North-west, for the reason that so many of them are perfectly hardy, they also grow very rapidly and soon make desirable shelter. In Plate iv, fig. I, a group of poplars is shown in the Arboretum at Indian Head. They are also easily propagated from cuttings. These may be made from the growth of the preceding year from 10 to 12 inches in length, cut off to near a bud at each end and buried in the soil so that the upper bud just shows above the surface. Such cuttings generally produce young trees from three to four feet high before the end of the season.

Populus balsamifera, L. Balsam Poplar.

This is a very hardy native tree which attains a large size as far north as the Mackenzie River and endures the climate well in all parts of the North-west. The leaves are rather large, ovate and pointed, deep green on the upper surface and whitish below. The buds of this tree are covered with a sticky gum which has a pleasant balsamic fragrance. From its sturdy growth this tree does good service in the shelter belt planted with other sorts.

P. balsamifera suaveolens.

A variety of the balsam poplar, said to be more fragrant than the common form. This tree has been tried both at Brandon and Indian Head, and found hardy.

P. berolinensis, Dippel.

This is one of the best of the Russian Poplars. It was first planted at the experimental farm at Brandon in 1889 and at Indian Head in 1890, and has shown continued hardiness ever since. It is a vigorous and upright grower, with rather large foliage and is proving a valuable tree for the North-west country.

P. certinensis, Hort.

Like *P. berolinensis* this is a Russian variety which is very hardy. It has been under continuous trial for 14 or 15 years, and has never shown any injury from winter.

P. deltoidea, Marsh. Cottonwood. North America.

The Cottonwood is one of the most vigorous and rapid growers of all the poplars, and has probably been more largely planted on the prairies than any other species. This is found native in the North-west, and is quite hardy in all the settled parts of Manitoba and the Territories. During recent years a yellow rust or fungus has occurred in many places on the under side of the leaves seriously injuring the trees and sometimes causing their death. An avenue of these trees grown at Indian Head is shown in Plate III fig. 5.

P. deltoidea aurea. Golden-leaved Poplar.

This is a very attractive variety with golden tinted foliage. It has been tested for 10 or 12 years and has only been injured by winter once, which was in 1900. At that time several were killed back one half at Brandon and others were killed outright at Indian Head.

P. laurifolia, Leder. Siberia.

In this species the leaves resemble those of the laurel in form, being oval, oblong and pointed. It is very hardy, having stood the winters at Brandon uninjured for the past six or seven years.

P. nigra, L. Black Poplar. Europe.

The European black poplar has been tested both at Brandon and Indian Head for the past five years, and has not during that time shown any injury from winter. This is also a rapid grower. The leaves are of a light green colour, slightly notched at their edges, and the branches greenish white.

P. nigra Nolestii.

A vigorous growing form of the black poplar, which has also proved quite hardy in the North-west.

P. petrowskyana, Sch.

This variety has been under trial for 14 or 15 years at the western Experimental Farms, and has proved hardy throughout.

P. tremuloides, Michx. American Aspen. North America. So named from the tremulous motion given to the leaves by the slightest breeze.

This is one of the most widely distributed of trees, being found from Labrador in the east to the Great Mackenzie Basin in the far north-west; it is also found in Alaska. The leaves are rounded, heart-shaped, terminating in a short, sharp point. The tree grows from 20 to 50 feet high, and is very hardy. Good shelter belts have been formed at Indian Head by planting young trees of this species five feet apart each way.

P. wobstii, Schroeder.

This is another of the European varieties of garden orgin, which has proved useful in the North-west country. It is a rapid grower and makes a handsome tree.

Among the varieties of Poplar which have proved more or less tender in the North-west are the following :—

Populus alba, L. White or Silver Poplar. Europe.

P. alba pyramidalis. Pyramidal Silver Poplar=*P. bolleana.*

P. grandidentata, Michx. North America.

P. nigra pyramidalis. Lombardy Poplar. Europe.

P. nigra betulæfolia. Birch-leaved Poplar.

POTENTILLA.

Potentilla fruticosa, L. Shrubby Cinque-foil.

This is rather an attractive shrub with pinnately cut leaves and yellow flowers. It is found in the northern parts both of Europe and America, and is native in Manitoba and in the Territories. For the past eight or nine years it has been tried in cultivation at both the Experimental Farms and found entirely hardy.

PRUNUS. Plum, Cherry.

In the genus Prunus are included the wild and cultivated forms of Plum and Cherry.

Prunus americana, Marsh. Wild Yellow or Red Plum. North America.

This species is found native throughout the greater part of the United States; also in southern Ontario in Canada. The flowers are white and are produced in great abundance before the leaves are fully expanded. The fruit is yellow or red, and varies much in different trees both in form and quality. The flavour of the fruit is usually pleasant, but the skin is tough and astringent. The tree has a spreading habit and bears large crops. The improved forms of this fruit, of which there are now many, are very desirable, and they are largely grown in districts in eastern and northern Ontario and in parts of Quebec where the better European sorts are too tender to succeed.

Some of these are hardy in the Canadian North-west, but the fruit is so late in ripening that it is generally cut by frost before it is fully matured. In specially favourable seasons these plums ripen fairly well, when they are very much appreciated.

P. nigra, Ait. Canada Plum. Canada, United States.

The Canada Plum is found wild throughout the greater part of Canada, also in the United States. It may be said to be the plum of the north and north-west. It is found wild in Manitoba, and is abundant in the river valleys in the southern parts of that province. It blossoms about a week earlier than *P. americana;* the fruit also ripens earlier. The fruit varies much in quality, form and colour, and in cultivation it has been found quite hardy all through the North-west country. The tree is more compact and upright in habit than *P. americana,* and on account of the earlier ripening of its fruit, the Canada Plum is much more useful. New varieties are frequently produced by selection and cross-fertilizing, and some of these ripen early enough in the North-west to mature their fruit every season before frost comes. A large number of seedlings have been grown at Brandon and Indian Head from some of the best and earliest ripening sorts, and have been distributed among settlers in many parts of the west for trial.

P. pennsylvanica, L. Pin Cherry. North America.

This species is found throughout the greater part of Canada from Nova Scotia to the Rocky Mountains. In the East it becomes a tree of from 20 to 30 feet high, whereas in the North-west it is reduced to the size of a large bush. The flowers are small, white, with many in a cluster; the fruit is very small, light red in colour, with a very thin layer of sour astringent flesh covering a relatively large stone. In the west much of this fruit is gathered and used for making jellies and for other household purposes. This tree is quite hardy under cultivation.

P. pumila. Sand Cherry. North America.

The sand cherry is a native shrub which is widely distributed. Macoun says 'it is found on sand beaches and plains on the Gaspé coast, and westward along the St. Lawrence and Great Lakes, and on the prairies to about the 106th meridian. In many parts of Manitoba it is quite common. It is a low growing shrub, with a pendulous habit, having white flowers and narrow willow-like leaves. The fruit which is usually produced in abundance varies much in size and quality. Sometimes the pulp is very thin and there is little more than a covering of skin over the stone, and the fruit is very astringent. Occasionally examples are found where the fruit is much larger, with a good proportion of pulp, juicy and of fair flavour. It may be grown from seed, layers, or cuttings. Young trees grown from seed ripened in the East, while hardy in their wood when planted in the North-west, often have their flower buds

killed in winter and bear no fruit. Those grown from seed ripened in the North-west, produce blossom buds which are seldom injured. The sand cherry is quite hardy in the North-west.

P. demissa, Walp. Western Wild Cherry.

In blossom and in fruit this much resembles the wild black cherry of the east, *P. serotina,* but the western wild cherry as seen in Manitoba and the Territories seldom grows to a height of more than 10 or 12 feet. It is very common, especially in the northern parts of Manitoba. The flowers are white and are borne in racemes, and the fruit is purplish black and astringent. This tree is very ornamental, especially when in bloom and succeeds well in cultivation. It has proved quite hardy both at Brandon and Indian Head.

P. grayana, Maxim. Japan.

This species has not been tested very long ; thus far it has been found hardy at Indian Head.

Prunus Maacki, Rupr. Manchuria.

This is a very vigorous growing shrub or small tree which attains a height of eight to ten feet. It has been under test since 1894, and has been found hardy both at Brandon and Indian Head.

Among the other species which have been tested the following have proved more or less tender :—

P. maritima, Waugh. Beach Plum. Eastern United States. Some seasons this has made fair growth and passed the winter without much injury; at other times it has been killed to the ground.

P. Mahaleb, L. Europe. Kills nearly to the ground in winter.

P. Maximowiczii, Rupr. Manchuria. This species has not been very long tested. Some seasons it has seemed fairly hardy, in others it has been killed back about one-half.

P. tomentosa, Thunb. Japan. This is usually killed during winter to near the ground, but sometimes it escapes with less injury, the winter killing extending only half way to the base.

P. serotina, Ehrh. Wild Black Cherry. Canada, United States. This eastern form has been extensively tested both at Brandon and Indian Head. It is usually killed nearly to the ground in winter.

PTELEA. Wafer Ash.

Ptelea trifoliata, L. Wafer Ash. Southern Ontario, United States.

The Wafer Ash is a large shrub with numerous stems proceeding from the root-stock. The flowers are small and whitish, the seed capsules have flattened wings, somewhat resembling those of the elm, but much larger. This shrub occasionally survives the winter without injury, but more commonly is killed back from one-third to one-half its length, and sometimes it is killed entirely.

P. trifoliata aurea. Golden Wafer Ash.

This differs from the type only in the golden yellow colour of its foliage.

PYRUS. Pear, Apple, Mountain Ash, &c.

Included in the genus Pyrus there are several trees and shrubs valuable in the North-west.

Pyrus baccata, L. Siberian or Berried Crab.

This species is widely distributed throughout Siberia, is found also in Japan and the Himalayas. In 1889 seed of this tree was obtained from the Imperial Botanic Gardens at St. Petersburg, Russia. Young trees raised from this seed were sent to the western Experimental Farms in 1893, and they have been grown there in increasing numbers ever since and have proved entirely hardy. *Pyrus baccata* is a handsome ornamental tree in the spring when covered with its white blossoms; also in the autumn when thickly hung with red or yellow fruit. The fruit varies in size from about one-eighth to three-fourths of an inch in diameter; in colour, through different shades of red to yellow, and in quality, it is sometimes fairly edible and sometimes unpleasantly astringent. The fruit of all these different forms makes good jelly, and on this account is useful to the North-west settlers.

These native forms are quite distinct from the new and improved types of cross-bred apples, which have been originated at the Experimental Farms by crossing *P. baccata* with different sorts of cultivated apples. These are hardy in the North-west and large enough to be of value for general domestic purposes.

There are quite a number of different forms of *P. baccata* in cultivation, but the differences in them are slight, and as they do not reproduce themselves truly from seed, they may be all classed together. The varieties referred to are :—

P. baccata auruntiaca.
P. baccala cerasiformis.
P. baccata edulis.
P. baccata flava.
P. baccata macrocarpa.
P. baccata microcarpa.
P. baccata sanguinea.

All these have been tried in the North-west and have proved entirely hardy

P. prunifolia, Willd.

This is also from Siberia. The flowers and fruit are both larger than *P. baccata,* the fruit varying from half an inch to an inch in diameter. The variations in colour and quality are similar to those in *P. baccata.* This species has been cultivated for more than a century, and is said to be the original of the garden crabs. In this species the calyx, or eye, of the fruit is usually persistent, whereas in *P. baccata* the calyx is usually deciduous, and drops from the fruit before fully matured.

P. prunifolia has been tested thoroughly at Brandon and Indian Head, and seems to be equally hardy with *baccata.*

This species has also several horticultural forms, of which the following have been tried and found hardy, but the differences are so small that, like those of *baccala,* they may be classed together.

P. prunifolia conocarpa.
P. prunifolia intermedia.
P. prunifolia oviformis.
P. prunifolia xanthocarpa.

P. americana, DC. American Mountain Ash.

This species much resembles the European Mountain Ash, but the tree is of much smaller growth. The berries also are brighter in colour and the clusters are larger, while the individual berries are smaller ; the leaves also are larger and bright green, shining above. The leaflets are lanceolate and taper-pointed in the American Mountain Ash, while they are oblong and obtuse in the European species.

The American Mountain Ash is a native of Canada, and is widely distributed, being found from Cape Breton, N.S., to Lake Winnipegosis, in Manitoba. It is also very common about the Lake of the Woods. Specimens obtained from the neighbourhood of Whitemouth, Man., and planted at Brandon and Indian Head have proved hardy, but specimens grown from eastern seed have been more or less tender.

P. aucuparia, Gaertn. European Mountain Ash.

This well-known tree forms an erect rounded head, and in favourable locations attains a height of 25 to 30 feet. It has not been successfully grown in the North-west. Occasionally a tree in exceptional shelter or at a low altitude will do fairly well and survive for a time, but it cannot be depended on. At the western Experimental Farms this tree has been thoroughly tested and has usually been killed back more or less each winter, and sometimes killed to near the ground.

The following additional varieties of *Pyrus* have been tested in the North-west and found too tender for the climate :—

P. alnifolia, K. Koch. Japan.

P. betulæfolia, Bunge. Birch-leaved Pyrus. China and Japan.

P. coronaria, L. American Crab Apple. Western Ontario.

P. Maulei, Mast. Maule's Japanese Quince.

P. rotundifolia, Bechst. Europe.

P. rivularis, Dougl. North America.

P. sinensis, Lindl. Chinese Sand Pear. China.

P. Sorbus, Gaertn. Service Tree. Europe.

QUERCUS. Oak.

Quercus macrocarpa, Michx. Mossy-cup Oak.

The only Oak native in the North-west is the Mossy-cup Oak. This is a very slow-growing tree, which is widely distributed, being found from New Brunswick to Manitoba. In the east it attains a good size and makes fair growth. Along streams and in sheltered localities in the North-west, also on the shores of Lake Winnipeg, some large specimens are found, but in exposed situations further west and north it reaches but a small size, and is known as 'scrub oak.' On the Experimental Farm at Brandon some very good examples of this stunted growth are found, and from acorns produced there a large number of seedlings have been raised, which have been planted at Indian Head and distributed among settlers in Manitoba and the Territories. These have proved entirely hardy. Its very slow growth interferes with the more general planting of this tree.

The only other Oak which has shown encouraging hardiness is an undetermined species grown from acorns received from Japan. Young trees of this variety have been under trial for several years, both at Brandon and Indian Head, and appear to stand the winter well.

The other oaks which have been tested and found too tender for the climate are :

Q. cerris, L. Turkey Oak. South and East Europe.

Q. coccinea, Muench. Scarlet Oak. North America.

Q. pedunculata, Ehrh. Common European Oak. Europe.

Q. pedunculata fastigiata. Pyramidal Oak.

RHAMNUS. Buckthorn.

The Buckthorns are shrubs of which a large proportion have proved hardy in the North-west. Grown as single specimens on the lawn, they are very shapely, and although the flowers are small and inconspicuous, when in fruit these shrubs are quite attractive. They are also useful for hedge purposes and are easily grown from seed.

Rhamnus alnifolia, L'Herit. Alder-leaved Buckthorn. Canada, United States.

This is a low-growing shrub from 2 to 4 feet high, which is a native of the North-west. It is quite hardy in cultivation. It has small, greenish inconspicuous flowers, and oval, acute serrate leaves from 1½ to 4 inches long. The fruit is black.

R. cathartica, L. Common Buckthorn. Europe.

This shrub has been under trial for the past six years, both at Brandon and Indian Head, and has proved hardy. The flowers are small and green, the fruit black and about ¼ inch in diameter. Leaves ovate in form, sharply toothed from 1 to 2 inches long and sub-opposite. This species is usually thorny.

R. davurica, Pall. Siberia to China.

This species of Buckthorn usually grows from 5 to 6 or 8 feet in height; is a large spreading shrub with stout thorny branches. The flowers are greenish-yellow and the berries black. The leaves vary in form from obovate to narrow lanceolate, and are from 1 to 2½ inches long. Hardy.

R. Frangula, L. Alder Buckthorn. Europe.

This is a strong growing shapely shrub, which when mature reaches a height of 5 to 8 feet. The flowers are small and whitish, the fruit dark purple, about ¼ inch in diameter, and the leaves are obovate, entire and alternate. This also is hardy.

R. infectoria, L. South Europe.

This is a low-growing shrub, about two feet high, which has been tested at the western farms since 1897. The first year it was slightly injured by winter, but since then it has passed the winters uninjured. The flowers are greenish-yellow and the berries black; the leaves are ovate, lanceolate, and the shoots are armed with spines, both terminal and lateral.

R. crenata, S. & Z., a Japanese species, has also been tested, but this has been found too tender for the North-west climate.

R. Purshiana, DC. British Columbia. Is also tender.

RHUS. Sumach.

In this family many of the species are killed to near the ground in winter, but send up shoots from the base in the spring, which make good-sized specimens by the autumn, when the foliage assumes brilliant shades of red and scarlet, which make them very attractive.

R. Canadensis, Marsh. (*R. aromatica,* Ait.) Fragrant Sumach. Eastern Canada.

This is a spreading shrub from four to six feet high, with small yellow flowers in clusters and aromatic leaves. It has been under test at Brandon since 1897. Some seasons it has wintered well, in others it has killed back more or less, usually about one-quarter, and in the severe winter of 1900 it was killed to the ground.

1.—ROW OF POPLARS IN ARBORETUM, INDIAN HEAD. 2.—BALM OF GILEAD *(Pop. Balsamifera)*, INDIAN HEAD. 3.—MANITOBA MAPLE *(Acer Negundo)*, INDIAN HEAD. 4.—AMERICAN ELM *(Ulmus Americana)*, INDIAN HEAD.

R. aromatica trilobata has only been recently tested, but as this species grows freely on the banks of the Saskatchewan, near Medicine Hat, also on the bluffs which margin the Belly river at Lethbridge, it is no doubt perfectly hardy. This is a very dwarf species with small foliage, which assumes brilliant tints in the autumn; height one to two feet.

R. glabra, L. Smooth Sumach.

This species is widely distributed in Canada from Nova Scotia in the east to the Saskatchewan river in the west. Specimens found in Manitoba and transplanted to the experimental farm at Brandon have been quite hardy. Eastern specimens sent to Indian Head have usually been more or less winter killed. In the North-west it grows from five to eight feet high, with large compound leaves and terminal panicles of crimson fruit.

R. cotinus, L. The Smoke or Mist Tree, also the variety known as *atropurpurea* have both been tested and found too tender.

RIBES. Currant, Gooseberry.

Only the wild forms will be referred to here.

R. alpinum, L. Mountain Currant.

This is found in the mountains of Europe. In cultivation it makes a compact and shapely bush, well clothed with foliage. The flowers are yellowish green and the fruit scarlet, insipid or sweetish. This has been tested at Brandon for the past ten years and found quite hardy; at Indian Head it has usually been killed at the tips and sometimes one-third to one-half. A dwarf form known as *R. alpinum pumilum* has been hardy at both farms, possibly because the dwarf form is better covered by snow during the period of low temperatures in winter.

R. americanum, Mill. Wild Black Currant.

This is found quite common throughout Manitoba and the Territories, and succeeds well in cultivation. The fruit resembles that of the cultivated black currant, *R. nigrum,* in flavour, but is stronger and less agreeable. The fruit also ripens more slowly and irregularly, which is a disadvantage when picking the fruit.

R. aureum, Pursh. Missouri Currant. Mississippi Valley to Rocky Mountains.

This is a yellow flowered currant which, when in bloom in the spring, is very showy and attractive. The flowers are fragrant and the fruit is dark brown to black. This has been tested for the past six years, both at Brandon and Indian Head, and found quite hardy. A garden variety with cut leaves known as *R. aureum tenuifolium,* has also been tested and found to be tender having been killed each winter from one-half to near the base.

The following have also been tested and found too tender :—

R. Gordonianum, Lem. A hybrid between *sanguineum* and *aureum.*

R. sanguineum, Pursh. From British Columbia; a very ornamental species with bright red flowers.

ROBINIA. Locust.

The Locust Tree, *Robinia pseudacacia,* so commonly grown in the east, has been tested in the North-west by the planting of several hundred young trees on both of the Western Experimental Farms for two or three years in succession, and they have in each instance all died the following winter.

ROSA. Rose.

The Rose is probably the most popular flower known, and it is in the double flowered garden form that it is most highly appreciated, where it combines a loveliness of form with a delightful fragrance. The wild roses as a rule are also sweet scented, and they have a simple charm and a beauty of their own which deserves attention, and their more frequent use in the shrubbery border and in clumps on the lawn is most desirable. Many varieties of roses have been tested in the west, both single and double, but comparatively few of them have been found hardy enough to endure the climate.

Rosa blanda, Ait. North America.

This produces a single rose about 1½ inches across, the flowers are usually pink, but sometimes white. Height, 2 to 4 feet. Hardy.

R. ferruginea, Vill. Purple-leaved Rose. Mountains of Europe.

This is an upright shrub from 4 to 6 feet high, with purplish branches and foliage of a dull purplish shade, more or less tinged with red. The flowers are small and of a deep red colour. This bush is effective in a group from its distinct purplish foliage. Hardy.

R. rubiginosa. Sweet Briar. Europe.

This well known garden favourite has been tested both at Brandon and Indian Head, but it has not proved generally hardy. It has usually been more or less injured by winter every season. One specimen planted at Indian Head passed through two or three winters without injury, but was killed back one-half in 1900, and has been killed back more or less several times since. It may, however, be considered half hardy.

R. rugosa. Thunb. Japanese Rose.

In this species the flowers are large, of different shades of red and rose; are fragrant and are thickly beset with sharp prickles. The branches are slender and well armed with prickles, and the foliage is wrinkled, shining and of great substance. The fruit is large and showy, and varies in colour from orange red to deep red. This rose has been tested in the North-west for about ten years and found to be generally hardy. Occasionally the tips of the branches are killed back more or less, but this is rare. There is also a variety with pure white flowers, which is very attractive, and another form producing red flowers which are loosely double ; both these varieties are also hardy. A hybrid of *R. rugosa,* with white loosely double flowers, known as Madame George Bruant, has survived the winter occasionally, but cannot be recommended as generally hardy.

Among the single varieties which have been tried and found tender are *Rosa cinnamomea, R. multiflora,* and *R. villosa pomifera.* These have all been killed back more or less during the winter, and sometimes killed to the ground. Many varieties of the hardiest sorts of Hybrid Perpetual roses have been tried. Some of them have been partly hardy for a time, but in the majority of instances they have died the first winter, and in no case have they survived more than two or three seasons.

RIBES. Raspberry, Blackberry, Dewberry.

In addition to the native wild raspberry, there are a number of cultivated varieties which succeed well in the North-west. All of the ornamental and cultivated forms of the blackberry and dewberry which have been tested have been found more or less tender.

SALIX. Willow.

Among the willows there are quite a number of species which are hardy in the North-west, and some of these make handsome specimens. As a family, however, they do not present very much variety. All the willows may be readily propagated from cuttings.

Salix alba, L. White Willow. Europe.

This species has been tested both at Brandon and Indian Head and found quite hardy. The leaves are ashy grey and somewhat silky, from 2 to 4 inches long, narrow and pointed. This tree is a rapid grower and serves a good purpose in a wind break; it also makes a handsome round-headed specimen when grown in the open.

S. alba argentea is a variety of the White Willow with leaves of a more silvery character. This has not been quite so hardy as the ordinary form, several of the specimens under trial having suffered more or less from winter-killing.

S. daphnoides, Vill. =*S. acutifolia,* Willd. The pointed or Sharp-leaved Willow. Europe.

This willow has been tried extensively in the North-west and found entirely hardy. It has been used for hedges, windbreaks, and also as single specimens, and has been very satisfactory. Grown in the open it soon makes a small tree from 10 to 15 feet high. The leaves are narrow and sharp-pointed, and the branches are covered with a whitish bloom.

S. fragilis, L. Brittle Willow. Europe, N. Asia.

This is a rapid grower and eventually makes a large tree. The leaves are large, lanceolate and pointed, with brown branches. This is a hardy variety, which has been tested in the North-west for the past eight or ten years, and has not been injured by winter.

S. longifolia, Muhl., is a very narrow-leaved willow which is found native in Manitoba and the Territories, and is abundant along some parts of the Assiniboine and Saskatchewan rivers, occasionally forming dense thickets. It is very useful for holding the earth along the banks of streams, but its habit of suckering makes it undesirable for general planting. The leaves are very narrow, long and pointed.

S. Nicholsoni purpurascens.

A very attractive species with purplish red twigs and long narrow leaves; a rapid grower and practically hardy.

S. pentandra, L. Laurel-leaved Willow. Europe.

The laurel-leaved willow is a very handsome and desirable species. When trained in tree form it develops a nice rounded head. The leaves are of medium size, rather short and pointed, the upper side having a fine polished surface. This glossy appearance of the leaves is quite characteristic. It makes an attractive hedge, but being a rapid grower needs frequent clipping.

S. rubra Forbyana. A red barked willow from Europe. This also is a rapid grower and quite hardy.

S. viticella Britzensis. In this variety the twigs are distinctly red and the leaves long, narrow and pointed. It is a rapid grower and quite hardy. This makes a very handsome hedge. (See Plate III, fig. 4).

S. Voronesh. Voronesh Willow.

This willow was introduced from Russia by Prof. J. L. Budd, of Iowa, U. S., and has been disseminated under the name of Voronesh Willow. The bark of this species is a bright deep yellow which makes it a striking object during the winter and early spring. Later in the summer the yellow colour becomes more subdued, although it is still distinctly yellow. The leaves are of medium size, narrow, long and pointed ; it is a very rapid grower and soon develops into a good sized tree. This is a very hardy sort.

Among the willows which have been tried and found more or less tender are the following :—

S. babylonica, L. Babylonian Willow, Europe.

S. babylonica annularis. Ringed Babylonian Willow.

S. Caprea, L. Goat Willow. Europe.

S. Caprea pendula. Kilmarnock Weeping Willow.

S. alba flava. Yellow White Willow.

S. nigra, Marsh. Black Willow. North America.

S. rosmarinifolia, L. Rosemary Willow. Europe.

S. sieboldiana, Blume. Japan.

S. purpurea pendula.

S. repens argentea.

SAMBUCUS. Elder.

Among the elders there are some desirable sorts which are useful in the Northwest. The wood of all of them is more or less tender, and most of the varieties are killed to the ground each winter, but the roots are hardy and send up strong shoots in the spring which form shapely and desirable shrubs before midsummer.

Sambucus canadensis, L. American Elder. North America.

This is a shrub which attains a height of five to ten feet, with white pith occupying the greater part of the stem. The large flat clusters of flowers are white and slightly fragrant, and the berries which ripen in August are black. In the Northwest this usually kills back, from slightly at the tips to half its length, and occasionally to near the ground.

S. nigra, L. Common European Elder. Europe.

In Europe this species forms a large shrub or small tree, but in this country owing to more or less winter killing annually it is seldom more than four to five feet. The leaves are compound with smooth deep green leaflets, the flowers cream coloured, slightly fragrant and the berries round and purplish black.

There are several fine varieties of this species.

S. nigra aurea nova. Golden Elder.

This is a very desirable sort, with golden leaves very ornamental. In the shrubbery border this forms a striking contrast with the green foliage of other shrubs. If the young shoots are regularly pinched off when they get the desired height, the golden colour of the leaves retains much of its brightness throughout the season.

S. nigra laciniata. Cut-leaved Elder.

A handsome form in which the leaves are finely cut into very narrow segments.

S. nigra pulverulenta alba.

In this variety the leaves are finely and thickly dotted with silvery white.

S. nigra fol. argenteis variegatis.

A form in which the leaves are variegated with silvery markings. All these are desirable and ornamental sorts, notwithstanding that they kill to near the ground every winter, as they make rapid growth in the spring and are handsome shrubs by midsummer.

SHEPHERDIA.

Shepherdia argentea, Nutt. Buffalo Berry.

A hardy shrub or small tree native in the North-west, which is common in the Qu'Appelle, Saskatchewan and other river valleys. When full grown it sometimes reaches a height of 10 to 12 feet. The flowers are small and rather inconspicuous, the male and female flowers being borne on separate trees. The leaves are rather small, oblong, ovate, entire and covered with silvery scales. The fruit is a berry about the size of a red currant, of a scarlet colour, acid and edible. This is quite hardy in cultivation, and young plants put out a foot apart soon make a good hedge.

Shepherdia Canadensis, Nutt. Canadian Shepherdia.

This is a lower growing species, with somewhat larger ovate leaves, which are green and nearly smooth above ; beneath they are silvery, more or less hairy, and dotted with rusty scales. In eastern Canada this shrub is found on the borders of lakes and rivers, and in Manitoba in some of the river valleys. The flowers are small and appear early in the season. The berries are sometimes red and sometimes yellow, sweetish and scarcely edible. This shrub is quite hardy, but is difficult to transplant successfully.

SPIRÆA.

The Spiræas are a very popular and useful class of ornamental shrubs, well adapted for the shrubbery border or for growing as single specimens on the lawn. The bushes are medium to low in size, and the flowers, which are small, white or pink, are very freely produced in showy clusters.

Spiræa arguta, Zabel. Of garden origin.

This is one of the best and earliest blooming sorts, and is quite hardy. It is also a free bloomer, and in the flowering season the bush is literally covered with feathery clusters of small white flowers. It usually grows about three feet in height and is rather slender and somewhat pendulous in habit.

S. Billardii. Of garden origin, said to be a cross between *S. Douglasi* and *S. salicifolia.*

This forms a shrub from 4 to 5 feet high, with long dense clusters of small bright pink flowers. This variety is later in blooming than *Van Houttei,* and is a desirable sort. There is also a white variety known as *Billardii alba.* Both of these have been tested in the Canadian North-west and have generally proved hardy.

S. chamædryfolia, L. Germander-leaved Spiræa. Siberia to Dahuria.

This species endures the winter in the Canadian North-west some seasons, while in others the branches are killed half way back or more. It usually blooms quite freely ; the flowers are white and grouped in hemisperical clusters, and are produced in June or July.

S. hypericifolia, L. Northern Hemisphere.

This species has wintered well at Brandon for several years, but has not yet been thoroughly tested at Indian Head. It is a vigorous, upright grower, producing numerous white flowers in umbels.

Spiræa trilobata, L.=S. cratægifolia. A native of Northern China and Siberia.

This is a bushy shrub about four feet high, with slender spreading branches and pure white flowers, which appear in clusters in May and June. It has proved fairly hardy both at Brandon and Indian Head.

S. Japonica alba=S. callosa alba.

S. Japonica rosea=S. callosa rosea.

S. Japonica superba=S. callosa superba.

These are handsome forms of *Spiræas*, with white or rose coloured flowers, which are natives of Japan and China. The bushes die to near the ground each year, but they start afresh from the roots and flower well later in the season.

S. salicifolia, L. White-flowered Meadow Sweet.

This species is found growing wild in many places in Manitoba, and is usually hardy in cultivation in most parts of the North-west. The flowers are produced in long dense terminal clusters. The leaves are narrow and pointed, resembling a willow, and the shrub is from three to four feet in height. There is also a rose-coloured variety. Both of these are hardy in cultivation.

S. sorbifolia, L. Sorbus-leaved Spiræa.

This is a very distinct form with long compound leaves and large compact terminal clusters of small white flowers. It is an upright shrub from three to four feet high, a native of northern Asia. It is hardy both at Brandon and Indian Head.

S. Van Houttei, Zabel. Van Houtte's Spiræa.

Of garden origin, said to be a hybrid of *S. Cantoniensis* with *S. triloba.*

This is a vigorous growing spiraea, one of the most beautiful of the early blooming sorts, and quite hardy. It grows from four to six feet high, with dark green leaves and white flowers about one-third of an inch across. These are arranged in clusters which literally cover the bush during the blooming season, making it a most attractive object. (See plate II, fig. 1.) This variety has been many years under test both at Brandon and Indian Head and has proved fairly hardy.

The following have been tried and found tender :—

S. Bumalda, Burvenich. Anthony Waterer.

S. bracteata, Zabel = *S. media rotundifolia.*

S. Douglasi, Hook.

SYMPHORICARPUS. Snowberry.

Symphoricarpus occidentalis, R. Br. Wolfberry or Snowberry. Western North America.

This is a native shrub very common in many parts of the Canadian North-west from the eastern margin of the prairies to the Rocky mountains. The flowers are pale rose-coloured and inconspicuous. The fruit is a white berry borne in clusters. It has been grown both at Brandon and Indian Head and found hardy. This shrub is compact in its growth and has been used at the Experimental Farm at Indian Head to form a low growing hedge around the margins of the flower beds, and its neat habit has made it quite effective. (See Plate V, fig. 2.)

S. orbiculatus, Moench. Coral Berry.

This is also found native in the North-west country, and is very plentiful in the neighbourhood of Edmonton, Alberta.

In this species the flowers are small and reddish, and the fruit dark red in imperfect clusters. It is very hardy.

SYRINGA. Lilac.

The Lilacs are universal favourites, and are beautiful both in flower and foliage. The flowers are in large showy panicles ranging from white through various shades of lilac, purple and red. In some varieties the flower clusters are produced so freely as to almost hide the foliage. There are several different species of lilac in cultivation, but the common lilac and its varieties are best known, and it is so hardy that it will succeed almost everywhere throughout the north and west. The fragrance of the flowers is sweet and rather heavy, if bunches of bloom are taken into the house ; but in the freshness of the garden the odour is delightful.

Many of the varieties of lilac seed freely, and where seeding is permitted to excess the shrub is much weakened and the bunches of bloom become fewer and smaller. To ensure vigorous growth the withered blossoms should be cut off after their beauty has faded, when the shrub will grow vigorously and produce later in the season strong, plump terminal buds from which fine clusters of bloom will issue the following spring.

Lilacs are easily raised from seed, but the seedlings vary much in the quantity and quality of their flowers. Some fine examples have been raised at the Brandon farm from seed of Charles 10th. (See plate I.) The best varieties are propagated by budding on the common stock or by striking cuttings. The latter method is preferable, as the shoots which come up from the roots of those budded on the common lilac produce inferior flowers and sometimes grow so strongly as to crowd and partially smother the branches grown from the bud, unless the undesirable shoots are promptly cut out; whereas if the shrub is on its own roots any shoots proceeding from it give flowers of uniformly good character. Lilacs are sometimes propagated by budding or grafting them on the privet, but this stock is objectionable on account of its tenderness and lack of vigour.

This useful group of ornamental shrubs contains several species and many splendid varieties which are quite hardy in the Canadian North-west. They are all very attractive when in bloom and the foliage is large and of deep rich shades of green, which makes the bush an ornament throughout the summer. The leaves are very free from insect attacks.

Syringa vulgaris, L. The Common Lilac. This was introduced to cultivation in 1597, and hence the lilac has been an object of admiration among lovers of flowers for more than 300 years. It is a native of Persia and Hungary, and when planted in good soil grows to a height of 10 to 15 and sometimes 20 feet. The Common Lilac is too well known to need description. Among the earliest recorded varieties of this species

is the single white form and a reddish sort known as *Syringa de Marley*. The first of the double sorts of the Common Lilac was introduced in 1870, and in recent years a large number of very handsome double and single forms have been produced. About thirty varieties have been tested at the Experimental Farms at Brandon and Indian Head, nearly all of which have been found quite hardy.

S. vulgaris Charles X. is one of the best of the single sorts. It is a remarkably free bloomer; its large clusters of rich reddish purple flowers are produced in such abundance as to make it a very striking object. The flowers are highly fragrant.

Among other sorts with single flowers of great merit are :—

S. v. Alba grandiflora, which produces very large trusses of charming white flowers.

S. v. Marie Legraye, a free bloomer with large clusters of white flowers ; an excellent variety.

S. v. Congo, a very distinct single lilac of a deep shade of purplish blue. The flower clusters are of medium size, but so dark in colour as to be very striking.

Among the double forms of *Syringa vulgaris* the following are very desirable :—

S. v Alphonse Lavallée. A very handsome form with beautiful bluish violet flowers in large clusters.

S. v. Charles Joly. Flowers a dark wine red with a pale underside and set in large, long clusters. One of the finest of the double sorts.

S. v. Condorcet. In this variety the individual flowers are very large, semi-double, pale blue, and produced in long panicles.

S. v. Dr. Maillot. This is a handsome double form which produces large trusses of flowers of a delicate pinkish purple. (See Plate II, fig. 6.)

S. v. Emilie Lemoine. Flowers very large and globular, of a beautiful rosy lilac colour, a free producer of large clusters of fine bloom.

S. v. Jean Bart. This variety is of a deep lilac colour in bud; when open the double flowers have a fine shade of purple. The inner petals are somewhat twisted, which gives the flower cluster a very graceful habit.

Mons. Maxime Cornu. A very distinct variety, the flowers of which are almost pink and borne in large trusses.

Madame Abel Chatenay has pure white flowers, very double, freely produced in good-sized trusses.

Madame Casimir Perier is another double white, producing large clusters of handsome flowers.

The above are all very desirable forms of *Syringa vulgaris*. They all produce handsome, fragrant clusters of bloom and are quite hardy. Many others are well deserving of mention, as there are now over one hundred varieties catalogued by European nurserymen.

S. chinensis, Willd., known also as *S. rothamagensis,* or Rouen Lilac, is a very desirable sort and much appreciated. It is said to be a hybrid between *S. vulgaris* and *S. persica.* The leaves are smaller than the Comon Lilac ; the bush is of a graceful habit, and the flowers, which are of a purplish violet colour, are produced in abundance in large clusters.

S. Josikæa, Jacq. Josika's Lilac is a robust-growing species, a native of Hungary. Its leaves are large and glossy, of a deep green colour above and paler below. The flowers, which appear from ten days to a fortnight later than the varieties of *Syringa vulgaris,* are of a bluish purple colour. The clusters are smaller than those of the Common Lilac, and they have very little perfume. When well established this variety blooms very freely, and on account of its lateness is seldom injured by spring frosts. It makes a beautiful hedge; its rigid habit and glossy, laurel-like leaves produce a fine effect. For hedge purposes young plants about 18 to 20 inches high should be chosen and planted in a single row 15 inches apart.

[Photos. by C. E. Saunders.]

1.—MANITOBA MAPLE HEDGE, BRANDON, MAN.

2.—FLOWER GARDEN IN FRONT OF SUPERINTENDENT'S HOUSE, INDIAN HEAD, N.W.T. LOW HEDGES MADE OF NATIVE SHRUB KNOWN AS SNOW BERRY.

S. villosa, Vahl., a native of the northern parts of China, is of recent introduction. It is lower growing than the common lilac, ranging from four to eight feet. The leaves are of medium size and ovate in form, the flowers are of an attractive shade of pale bluish rose, with a waxy looking surface and a pleasant fragrance, but not nearly so strong as *S. vulgaris*. This shrub is a charming addition to the lilac group, a free bloomer, with flower clusters of medium size. Its time of blooming is about two weeks later than the common lilac.

S. Japonica, Decne. Japan Lilac.

The Japanese tree lilac was first brought from Japan in 1885. When full grown it forms a small tree from ten to fifteen feet high. The flowers are small, creamy white and are produced in large dense clusters. They have a fragrance quite distinct from that of the ordinary lilac, reminding one of the hawthorn, or the privet. The leaves are large and of dark green colour. This is the latest of all the lilacs to bloom, the flowers appearing in Ottawa during the last week in June or the first in July.

With a judicious selection of the species and varieties referred to one may have a succession of lilacs in bloom for from four to five weeks. All those referred to have been tested at Brandon and Indian Head and have proved hardy.

TAMARIX. Tamarisk.

Tamarix amurensis. Amur Tamarisk.

This is a graceful shrub producing a feathery growth of branches which are covered in June with small pale pink flowers. It succeeds fairly well at Ottawa, but has proven too tender for the Canadian North-west.

TILIA. Linden.

Tilia americana, L. Basswood or American Linden. North America.

The basswood in eastern Canada is a widely distributed tree of handsome form and fine foliage. Young trees grown from seed ripened in the east have not been hardy either at Brandon or Indian Head. There are, however, some native basswood trees growing in Manitoba, in the Turtle Mountain district, and the neighbourhood of Carman, and in some other parts of the province, and trees grown from seed ripened in any part of Manitoba have proved quite hardy at Brandon and fairly hardy at Indian Head.

Tilia vulgaris, Hayne. European Linden.

The European Linden has also been tried at both the Western Experimental Farms, but it has usually been killed to the ground or killed outright the first winter. Several specimens, however, have survived in sheltered locations and at Indian Head there are now three specimens eight or nine years planted which seem to be quite hardy.

ULMUS. Elm.

Ulmus americana, L. American Elm.

The American elm is one of the best and most durable of trees for ornamental or shade purposes. As a street tree or for avenues it is unsurpassed, its beauty of form, durability and freedom from disease place it in advance of most other trees for such purposes. In Manitoba and the North-west Territories it is as yet very free from insect pests. The American elm delights in low, moist and rich soils, and is found in all parts of Eastern Canada. It occurs native also in many of the river valleys in Manitoba. Macoun says, 'it is found in the valley of the Red river from Pembina

to Lake Winnipeg. It ascends the Assiniboine to its source. It passes by the way of Lakes Manitoba and Winnipegosis to Red Deer River which flows into the last named lake where it ceases to grow in latitude 53°. On the Saskatchewan it ascends to near Cumberland House in latitude 54°.

Trees grown from seed produced in the east are more or less tender and unsatisfactory, while those grown from seed ripened in Manitoba or the Territories are quite hardy. Young seedlings may usually be found in abundance growing under or near by mature elms in river valleys in the North-west, and if dug up and transplanted into good soil will grow rapidly, and soon develop into vigorous and shapely trees. (See plate IV, fig. 4.)

U. racemosa, D. Thomas. Cork or Rock Elm. North America.

This tree is common in some parts of eastern Canada, but has not been found native in the North-west. A large number of young trees of this species were planted in 1889 both at Brandon and Indian Head. Those planted at Brandon all died within a year or two, while a few of those planted at Indian Head in a small nursery where they had much shelter, survived, and several of them are still living. These have now attained a fair size and seem quite hardy. As soon as these trees bear seed it is probable that a hardy race of Rock Elm can be produced.

VIBURNUM. Arrowwood.

The Viburnums deserve a place among our most esteemed ornamental shrubs. They are decorative when adorned with their clusters of white flowers, also when in fruit. The foliage is handsome and assumes warm tints of colour in the autumn. Several of the species are hardy in the Canadian North-west. They can all be raised from seed, but this is slow to germinate. It seldom grows until the second year, and instances are known where germination has been delayed until the fourth and even the fifth year after sowing.

Viburnum lentago, L. Sheepberry, Nannyberry.

This species is found in many parts of eastern Canada, and also in the North-west in the valleys of the Red, Assiniboine and Saskatchewan rivers. It varies in height from 6 or 8 to 15 feet or more. The leaves are ovate, pointed, from 2 to 4 inches long, and the flowers are in flat clusters, varying from 2 to 5 inches across. The fruit is oval and of a bluish black colour. This is a handsome shrub, which is quite hardy in most parts of the North-west.

V. opulus, L. High-bush Cranberry.

This species is found in the east as far as Anticosti Island; it is also a native of the North-west, and is very generally distributed throughout the northern parts of Canada. The High-bush Cranberry attains a height of from 6 to 10 feet or more and makes a handsome ornamental shrub, which is interesting when in flower and very decorative when adorned with its bright scarlet fruit. The berries grown on the eastern form of this shrub are very bitter, while those grown in the North-west are pleasantly acid, without bitterness, and are used by the settlers for the making of pies, preserves, &c. This difference in the fruit is so marked as to lead one to suspect that they may belong to different species.

V. Opulus sterile. Snow-ball or Guelder Rose.

This is a well-known form of *Viburnum opulus,* which has been long in cultivation, in which the fertile flowers are nearly all changed to sterile, showy ones. When this shrub is in full bloom the flowers, which are a snowy white, form numerous large globular heads, which are very attractive. On this sterile variety it is seldom that any fruit is formed, and it is propagated from suckers, layers or cuttings.

This variety is nearly hardy at Brandon and Indian Head; occasionally the tips of the branches are injured by winter, and if the season is very severe they may be killed from one foot to half way to the ground.

Vilburnum Lantana, L. Wayfaring Tree.

This is an upright and handsome shrub, with medium-sized, strongly veined, bright green leaves, producing flowers nearly white, in terminal flat clusters, which are succeeded by bright red berries, which gradually change until they become nearly black. This is a native of Europe, which has been tested at Brandon and Indian Head for the past eight years. At Brandon it is seldom injured by winter, and generally blooms well; sometimes, however, the blossom buds are injured. At Indian Head many of the shoots are killed back, but some usually escape injury, so that the bush flowers fairly well. Although not entirely hardy, it is so nearly hardy as to be well worth growing.

V. dentatum, L. Arrow-wood.

This is found native in different parts of Canada from New Brunswick to Ontario, also in the United States as far west as Minnesota. It is a handsome shrub (See Plate II, fig. 3) of upright and compact growth, with coarsely toothed leaves and flat clusters of white flowers from two to three inches across. The fruit is in small clusters, nearly round and of a bluish black colour. Although not yet thoroughly tested, it is probable that this shrub will prove hardy in the North-west.

Other varieties of Viburnum are being tested, and it is probable that additional hardy species will be found.

VITIS. Grape.

Vitis vulpina, L. *V. riparia,* Michx. River Bank or Frost Grape.

A vigorous tall growing climbing vine found on river banks and in low thickets which produces sweet scented clusters of flowers, and later small compact bunches of round purplish black grapes, covered with a blue bloom. The fruit is acid and if picked before frost is austere and unpleasant, but after frost it becomes much sweeter and quite palatable.

This species is common in Eastern Canada, and is found also in the valleys of the Red, Assiniboine and other rivers, especially in the southern parts of Manitoba. Plants raised from seed are frequently sterile, producing staminate flowers only. In such cases, the flower clusters are unusually large and abundant. To secure fruiting vines young plants should be raised from cuttings taken from vines known to be fruit bearing. Hardy both at Brandon and Indian Head.

CONIFERÆ.

ABIES. Fir, Spruce.

Abies balsamea, Mill. Balsam Fir.

This evergreen has a wide native range, is very abundant in Ontario and Quebec and in Eastern Canada generally; it is also found native in the North-west country. It occurs in the Lake of the Woods district and the valley of the Saskatchewan. Macoun says, 'it occurs around James Bay, and has been found on the Athabasca river in latitude 58°.'

The balsam fir has been tested at the experimental farms at Brandon and Indian Head for the past ten years. Young trees brought from the east have not been entirely hardy, but when obtained from the neighbourhood of Rat Portage, they have proven quite hardy. They are, however, of slow growth.

The variegated form of this tree, *Abies balsamea variegata,* obtained from Europe has also been tried and found fairly hardy.

JUNIPERUS. JUNIPER.

Among the junipers there are not many species hardy enough to endure the winters of the Canadian North-west.

Juniperus Sabina, L. Common Savin.

This handsome evergreen, native in the mountains of Europe, has been tested for the past eight years, both at Brandon and Indian Head and found hardy. It has a low growing spreading habit, rarely attaining a height of more than three feet. When well rooted it grows rapidly, and its rich deep shade of green makes it a desirable object on a lawn. It succeds well also under partial shade.

J. Sabina variegata is a variegated form of the Common Savin, and *J. Sabina,* var. *erecta* an upright growing variety of the same, both of which have been tested in the North-west and found hardy.

J. Sabina procumbens. Creeping Savin.

This grows abundantly in some parts of Manitoba and the Territories, preferring sandy and rocky places where the soil is poor and barren, sometimes covering acres of ground with a carpet of green. It grows about six inches and upwards in height. Several attempts have been made at the experimental farms to transplant this creeping form of savin, but without success. Probably the soil in which it has been planted has been too rich. If it could be successfully transplanted there is no doubt about its hardiness. Macoun gives the distribution of this species as from Anticosti Island to the summit of the Rocky Mountain passes.

J. virginiana, L. Red Cedar, Virginian Juniper.

This well known ornamental tree is found growing on dry, rocky and somewhat sterile soils in different parts of Eastern Canada. It varies in size from a shrub to a small tree and under favourable conditions develops into a good sized tree of 50 feet or more in height. It is found in abundance in many parts of Ontario, from Ottawa to the shores of Lake Erie, and as far north as Parry Sound. The red cedar has been repeatedly tried at Brandon and Indian Head during the past fourteen years, and while a large proportion of the specimens planted have died, a few have survived at each farm gaining apparently in hardiness from year to year, and for the past five or six years seem to have become quite hardy.

J. virginiana elegans is a handsome variety of this tree, which has been tried for several years at the North-west farms, and has shown a fair degree of hardiness. As yet, however, the specimens are small and usually have the advantage of being covered by snow during the coldest winter weather. Among the other varieties of Juniper which have been tried and found more or less tender are :—

J. communis, L. Common Juniper.

J. communis fastigiata. Irish Juniper.

J. virginiana pyramidalis = *J. fragrans.*

J. virginiana Schotti.

PICEA. Spruce.

Among the Spruces are found some of the most valuable evergreen trees for the North-west plains.

Picea alba, Link. White Spruce.

This is a very handsome evergreen tree which, when grown in open places, assumes a compact pyramidal form, branching almost to the ground. It is found in all parts of eastern Canada, from Gaspé to north of Lake Superior. In Manitoba it is very common on the sand hills which margin the first prairie steppe. Macoun says: 'Occasional trees are met with in the Saskatchewan valley and in the Cypress Hills.' It has also been found on the Athabasca river in latitude 54°.

When trees of this species are grown from seed produced in eastern Canada and sent to Manitoba or the Teritories they are usually tender, and if planted in exposed situations a large proportion of them die the first winter. If, however, they are brought from the sand hills on the first prairie steppe in the neighbourhood of Sewell and north and south of that point where young trees can be found in great abundance, they are perfectly hardy. Many hundreds of these trees have been planted at the Experimental Farms at Brandon and Indian Head, and no injury from winter has ever occurred to them. At Brandon one of the finest hedges on the farm is white spruce. See Plate III, fig. 2. This is one of the most valuable trees for planting in the North-west, provided the specimens set out are native. In transplanting these or any other evergreen trees great care should be taken to keep the roots moist during the time they are out of the ground. If the root fibres are permitted to dry the young trees will be very much injured. To prevent this the roots should be well wet as often as is necessary and covered with wet moss or wet sacking during time of removal. With the exercise of due care, the white spruce, provided the trees are small, may always be transplanted successfully. Well grown bushy specimens, from 1½ to 2 feet high, are quite large enough. Attempts to transplant trees from 4 to 6 feet high are almost always a partial if not an entire failure.

Picea nigra, Link. Black Spruce.

This is said to have a wider range than the White Spruce, and to extend from northern Labrador to Lake Athabasca (lat. 59°). It is very much like the White Spruce in appearance, and the two species are frequently confounded. They may, however, be distinguished by the length of the cones, which are shorter in the Black Spruce, seldom an inch long, while in the White Spruce they are longer, and never under an inch in length. The needle-like leaves of the Black Spruce are also usually shorter than those of the white variety. The Black Spruce is said to form the great bulk of the spruce trees which furnish the large stretches of timber found in many of the northern parts of Manitoba, west of Lake Winnipeg, and in the northern parts of the Territories.

The Black Spruce also makes a very handsome tree, see Plate VI, fig. 4, and is quite hardy if grown from seed ripened in the North-west. Many young trees have been brought from the vicinity of Rat Portage to both the North-west Experimental Farms, and have succeeded well.

P. Engelmanni, Engelm. Englemann's Spruce.

This species grows in abundance in the Rocky and Selkirk Mountains, where it attains a height of 100 to 150 feet, with the trunk sometimes four feet in diameter. Three young treees were brought from Glacier in 1895 and planted at Indian Head, where they have proven hardy.

Picea excelsa, Link. Norway Spruce.

This handsome and well known evergreen is a native of the mountains of Northern Europe, and has repeatedly been tested at Brandon and Indian Head dur-

ing the past fourteen years. A large proportion of the trees planted have died, but a few have manifested unusual individual hardiness and have survived. The survivors have gradually become acclimatized and now appear to be quite hardy. They have grown to be handsome specimens, and good examples of this species may now be found at both of the North-west Experimental Farms. As some of these trees have begun to bear cones, seed will shortly be obtainable from them for sowing, and trees grown from such seed will probably be quite hardy from the start.

Picea pungens, Engelm. Rocky Mountain Blue Spruce.

This is probably the most attractive evergreen of recent introduction. It is found at high elevations in Colorado where it is seen of various tints of colour from a plain green, through different shades of steely blue, some slightly blue while others are of a deep, bright, steely or greyish shade of a very striking character. This blue colour in the best of specimens almost disappears in winter, but with the first warm days of spring the lower branches of the tree begin to brighten, and a deep bluish tint gradually creeps upward until it pervades the whole tree. By this time the buds begin to burst and the new growth pushes out of a much brighter shade, and this bright colour is maintained until the autumn when it changes gradually to a deep green. The tree has a compact pyramidal habit with the branches produced each year extending almost horizontally, showing more or less distinctly the separate layers of annual growth, giving the tree a storied appearance. The leaves are longer and much stiffer than in most of the other species of spruce. The blue colour of the foliage is produced by a waxy secretion on the needle-like leaves, a sort of bloom which when rubbed is easily removed. The varying shades of colour in different trees results from the relative density and brightness of this bluish bloom. Nurserymen engaged in propagating this spruce usually select seed from the bluest specimens, when a considerable proportion of the seedlings usually show the blue colour more or less strongly. The seedlings, however, vary much in this respect. In Europe this tree is propagated by grafting twigs from some of the bluest trees on young Norway or white spruce, when the young trees so grown are all uniformly blue. In Europe these grafted trees of *Picea pungens* are usually sold under the name of *P. Parryana glauca.*

The Rocky Mountain Blue Spruce has been under test both at Brandon and Indian Head since 1896, and has proven quite hardy, see Plate VI, fig. 1 from photo of specimen at Indian Head. For several years the specimens planted made slow growth, and occasionally showed slight injury from winter, but since they have become well established their growth has been satisfactory, and for the past six years they have shown no indication of injury from winter.

PINUS. Pine.

There are not many of the pines which furnish satisfactory material for planting on the North-west plains. Since they have but few fibrous roots, they are difficult to transplant, and efforts to grow pines are sometimes unsuccessful for this reason rather than from lack of hardiness.

Pinus divaricata, Dum.-Cours., =*P. Banksiana,* Lamb. Labrador Pine, Banksian Pine, Jack Pine.

This is a northern species with a very wide distribution. Macoun says it extends from Halifax, Nova Scotia, north-westerly to the Athabasca river and northerly down the Mackenzie river to the Arctic circle. When grown without being crowded this is rather a pretty tree. The leaves are in clusters of two, are rather short, seldom over an inch long, more or less curved and of a light green colour. It is difficult to transplant, and the efforts made to move young trees from the districts about Rat Portage, Prince Albert and Edmonton to the North-west Experimental Farms have

not always been successful. There is, however, no lack of hardiness in this variety, and if transplanted very young, when only eight or ten inches high, this tree can usually be moved successfully. This is a slow growing species.

P. cembra, L. Stone Pine. From Mountains of Central Europe and Siberia.

This tree makes a close, erect symmetrical growth. The leaves are 2½ to 3 inches long in clusters of five. They are slender, flexible, and somewhat triangular, one side a smooth green, the other two with silvery white lines. It is a very slow growing tree, and requires many years before a specimen reaches any considerable size. The Stone Pine has been under test since 1896, both at Brandon and Indian Head, and has proved quite hardy.

P. sylvestris, L. Scotch Pine. Northern Europe.

This well known evergreen tree has a symmetrical upright habit of growth, and when allowed sufficient space for development makes a very shapely tree. The leaves are arranged in clusters of two, are from 2½ to 3 inches long—shorter in old trees—somewhat flattened and twisted, and of a dull, bluish green colour.

Several hundred young specimens of the Scotch pine were planted at each of the North-west Experimental Farms in 1889 and 1890. At that time there was very little shelter to protect them, and a large proportion died during the winters of 1890 and 1891. A few, however, survived, either from individual hardiness or more favourable surroundings as to shelter, and maintained a somewhat stunted growth for several years, during which time they became established, and have since made satisfactory progress. For the past seven or eight years they have been quite hardy.

P. sylvestris Rigaensis. Riga Pine.

This is said to be a somewhat hardier form of the Scotch pine grown from seed obtained in forests near Riga, Russia. A number of young trees of this variety have also been tried both at Brandon and Indian Head. These were put out in 1890, and subsequent years, and some of the trees have survived. The Riga pine has a more upright habit of growth than the ordinary Scotch pine, otherwise they seem to be identical, see Plate VI, fig. 2.

In planting young Scotch or Riga pines in the North-west small well rooted specimens should be chosen, and they should be put, where possible, in the shelter of some protecting trees. This tree, however, is a very hardy one, and would probably endure the winter even in a moderately open place if some slight protection were afforded. If a stake were driven down near the tree and a wisp of straw wound around to protect the foliage this would no doubt help to carry it through the winter.

P. montana, Duroi. Mountain Pine. From Mountains of Central Europe.

This is a large, rather compact, bush-like form of pine, from 5 to 15 feet in height, very suitable for planting where space is limited. The leaves are in pairs about two inches long, somewhat twisted, and of a dark green colour.

A considerable number of young specimens of the Mountain Pine were planted at Brandon and Indian Head in 1890 and 1894, a large part of which died. A few survived, which have gradually acquired greater hardiness, and those which are now growing in shelter appear to be quite hardy.

In planting the Mountain Pine in the North-west, small, well-rooted specimens should be chosen, and they should be so placed as to have the shelter of other established trees.

P. montana mughus. Dwarf Mountain Pine.

This is a low-growing and very compact form of the Mountain Pine, which makes a neat and attractive specimen. In hardiness this is similar to the ordinary larger form. The Mountain Pine appears to be somewhat less hardy than the Scotch Pine.

Pinus ponderosa, Dougl. Heavy wooded Pine, Bull Pine. From the drier districts in British Columbia.

This is a handsome species of pine, which is the principal tree occurring in the central and southern dry regions in British Columbia. When mature, it is a large tree with widely spreading branches and light red, scaly bark. The leaves are in clusters of three, rather stout and very long, measuring from 5 to 6 inches.

This species has been tested during the past ten years, both at Brandon and Indian Head, and a very large proportion of the trees planted have been winter-killed, and most of the survivors suffered badly during the severe winter of 1900. Specimens have, however, survived at each of the North-western farms, but the growth has been stunted. Some of the best of the surviving specimens at Indian Head, growing in a sheltered spot with some Scotch Pine, were unfortunately destroyed recently by a fire which occurred in some dry grass in the neighbourhood, and which spread over this small plantation.

This species may be regarded as tender in the North-west, especially in severe winters, unless afforded exceptional conditions as to shelter. It is quite hardy at Ottawa.

Pinus Strobus, L. White Pine.

This species has been several times tested at both the North-west farms, but has been found too tender to endure the climate. Most of the specimens planted have died the first winter. The only young trees thus far obtainable have been grown from eastern seed. In Macoun's Catalogue this species is said to occur between Lake Superior and Winnipeg River around Lonely Lake ; also near Lake Winnipeg. If young trees from these northern localities could be obtained they would in all probability prove hardy.

P. resinosa Soland. Red Pine.

This beautiful pine is common in eastern Canada, and is known to extend west of the Lake of the Woods. It has been found difficult to procure young trees of this species from northern sources, hence tests were not begun with Red Pine until 1902. The results obtained thus far are promising as to hardiness, but not yet conclusive.

The following have been tried and found too tender to endure the North-west climate :—

Pinus Laricio nigricans. Austrian Pine.

Pinus contorta murrayana. Lodge Pole Pine.

Tsuga canadensis, L. Hemlock.

Pseudotsuga Douglasii, Car. Douglas' Spruce.

Thuja occidentalis, L. Arbor-vitæ, White Cedar.

This is a well-known and widely distributed tree in Quebec, Ontario and New Brunswick, and extends northwards to the eastern extremity of Lake Winnipeg in Manitoba. Many specimens have been planted in the city parks at Winnipeg, which have been brought in by settlers within a few miles of the city. This tree is of a conical form with a dense frond-like foliage of a bright green colour in the summer, but which assumes a dull green hue during the winter months.

A large number of young trees of Arbor-vitae were planted on the Experimental Farms at Brandon and Indian Head in 1889, but most of these being without shelter, died during the winters of 1890 and 1891. Many additional specimens were planted in subsequent years, after some shelter had been provided, and some of these have now stood the winters for five or six years, and appear to be quite hardy. The experience gained indicates that young Arbor-vitæ trees brought from the east are not usually

[Photos. by C. E. Saunders.]

1.—ROCKY MT. BLUE SPRUCE, INDIAN HEAD.
2.—RIGA PINE, INDIAN HEAD.
3.—EUROPEAN LARCH *(Larix Europea)*.
4.—BLACK SPRUCE *(Picea Nigra)*.

hardy in the North-west in exposed situations, but that they are fairly hardy when planted in sheltered spots. There is little doubt that young native trees from near Winnipeg would be much hardier than those brought from the east.

There are many very distinct varietal forms of the Arbor-vitæ, which have also been tested at the Brandon and Indian Head farms, and the following, when planted in sheltered situations, appear to be about equally hardy with the common Arbor-vitæ.

T. occidentalis elwangeriana. Elwanger's Arbor-vitæ. A variety with distinctly finer foliage and semi-dwarf habit.

T. occidentalis Hoveyi. Hovey's Arbor-vitæ. A compact form with the foliage in large flat plates which open and close gracefully with the wind.

T. occidentalis variegata. Variegated Arbor-vitæ. A variety resembling the ordinary form with the tips of the foliage white.

T. occidentalis Columbia. Columbian Arbor-vitæ. A semi-dwarf form in which the silvery tipping is deeper and more constant than in variegata.

T. occidentalis Wareana. Ware's Arbor-vitæ. A semi-dwarf variety, forming a dense nearly oval mass of foliage from six to eight feet high, very regular in outline and coarser in foliage than the ordinary type.

T. occidentalis aurea (Douglas). Douglas' Golden. A semi-dwarf form, widely tipped and splashed with golden shades.

T. occidentalis lutea. A dwarf form with the larger part of the foliage of a golden hue.

The following varieties have also been tested and appear to be more tender :—

T. occidentalis pyramidalis. Pyramidal Arbor-vitæ. A form of the tree which assumes the character of a dense elongated pyramid with a narrow base.

T. occidentalis Meehani. Meehan's Arbor-vitæ. A golden tinted semi-dwarf form where the golden hue extends down the foliage in a broken character for three or four inches from the tips.

There are several other forms of a dwarf character, such as *T. O. compacta* and *T. O. globosa,* which have not yet been tested, but which will in all probability prove as hardy as the common form of the Arbor-vitæ.

LARIX. Larch. Tamarack.

The larches, although they shed their leaves during the winter, are true conifers, and are entitled to consideration here.

Larix laricina (Du Roi), Koch. American Larch, Tamarack, Hackmatack.

This tree has a very wide distribution. 'With the black spruce it occupies the larger part of the swampy ground from Newfoundland, Labrador and the eastern provinces to the eastern base of the Rocky Mountains in the Peace river region, latitude 56°' (Macoun). The American larch is of medium height, of rather slender growth, sometimes pendulous in habit, usually found in swampy woods or on the margin of lakes. The leaves, which appear early in spring, are narrowly linear in form and arranged in fasicles or clusters, soft and of a bright green colour ; the cones are small from ½-inch to ¾-inch in length.

A number of young trees of this species have been procured from the neighbourhood of Rat Portage, also from among the sand hills at Sewell, Man., on the first prairie steppe. These have grown well and have proven quite hardy at Brandon and Indian Head.

L. europæa, DC. European Larch.

This is a tall, handsome pyramidal tree of rapid growth and robust habit, found native in the European Alps. The leaves are linear, soft and arranged in fasicles

as in the American Larch, but usually average a little longer, and are of a deeper shade of green. The cones are about twice the length of those of the American Larch, measuring from 1 to 1¼ inches in length ; the branches are usually more or less pendulous. The regularity and beauty of its outline during every stage of its growth makes this tree a favourite object for decorative purposes. (See Plate VI., fig. 3.) Unfortunately it cannot be said to be hardy in the North-west. Out of several hundred young trees planted at the North-west farms at different times during the past 14 years, only a very few specimens have survived. These, however, seem to have become quite hardy and are growing well. As soon as seed can be obtained from these acclimatized trees it is probable that a hardier race may be produced.

There is another species of larch known as the Mountain Larch (*Larix Lyalli*), which may probably prove hardy in cultivation in the North-west. This tree is found in the Rocky Mountains at an altitude of from 6,000 to 7,000 feet, but no opportunity has yet occurred for making a satisfactory test of this species.

SALISBURIA.

Salisburia adiantifolia, Smith. Maiden Hair Tree.

Several specimens of this interesting tree have been tried at each of the western farms, but in no case have they survived a winter.

S
133
.E22

GENERAL LIBRARY,
UNIV. OF MICH.
MAR 17 1905

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

RESULTS OBTAINED IN 1904

FROM

TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS

AND

POTATOES

BY

WILLIAM SAUNDERS, LL.D.
Director of Experimental Farms.

AND

CHAS. E. SAUNDERS, Ph. D.
Experimentalist.

BULLETIN No. 48

DECEMBER, 1904.

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER,
MINISTER OF AGRICULTURE

TABLE OF CONTENTS

	Page.
Results of Experiments with Spring Wheat	8
" " " Macaroni Wheat	13
" " " Emmer and Spelt	15
" " " Oats	17
" " " Six-rowed Barley	21
" " " Two-rowed Barley	23
" " " Pease	27
" " " Indian Corn	30
" " " Turnips	34
" " " Mangels	39
" " " Carrots	45
" " " Sugar Beets	49
" " " Potatoes	53
Summary	58

To the Honourable
The Minister of Agriculture.

SIR,—I herewith submit for your approval Bulletin No. 48 of the Experimental Farm series, which has been prepared by the Experimentalist, Dr. C. E. Saunders and myself. There are presented in this publication the results of a large number of experiments, which have been conducted at all the experimental farms in your Department during the season of 1904, with spring wheat, macaroni wheat, emmer and spelt, oats, barley, pease, Indian corn, turnips, mangels, carrots, sugar beets and potatoes, in plots of uniform size, and with the crops grown under uniform conditions. The average results are also given of the tests for a series of years of those varieties which have been long under trial.

These test plots are conducted with the object of gaining information as to the relative productiveness of the different sorts and their earliness in ripening. The returns show much variation in the weight of the crops grown and point to the importance of care in the choice of varieties of seed for sowing. It is hoped that these results giving the experience gained under some of the most important climatic variations found in the country, will prove useful to farmers in every part of Canada.

I have the honour to be,
Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, December 27, 1904.

RESULTS OBTAINED

FROM TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS AND POTATOES

By William Saunders, LL.D., F.R.S.C., F.L.S., F.C.S., &c.
Director of Experimental Farms.

And Chas. E. Saunders, B.A., Ph.D., Experimentalist.

During the past ten years experiments have been conducted on uniform trial plots at each of the Dominion Experimental Farms for the purpose of gaining information as to the most productive and earliest ripening varieties of grain, fodder corn, field roots and potatoes. In arranging for these plots the same varieties have been sown at each of the farms, the seed being supplied at the outset from a common stock. In each case seed has been sown early, and, as a rule, all the different sorts of the same crop have been sown on the same day or at most within two or three days so as to give to all an even start. The land chosen each year for these plots has been as nearly uniform in character as could be found and before sowing has been brought into a good condition of tilth. In this bulletin which is the tenth of the series, considerable changes have been made in the manner of presenting the results of the experiments. Although in the previous issues attention has been called to the fact that the figures obtained in any one season are of much less significance than those which express the average of the returns for a series of years, nevertheless it has been felt that this important fact has not always received due consideration. It has therefore been decided to arrange the matter in such a form as to bring into prominence the average results and to relegate the figures obtained in the current year to an altogether subordinate place. In this way it is believed that the usefulness of the bulletin will be materially increased. Another change has also been considered necessary. Experience has shown that the results obtained from growing different varieties for a series of years on one farm and under uniform conditions

cannot be safely compared together unless exactly the same years are used in computing all the averages. This is due of course to the variability of the seasons. A period of five years has therefore been adopted as the standard, and the varieties are placed in the tables in the order of their average yield for the last five years. Those which have only been grown for shorter periods are placed in a separate group. While a five-year period is undoubtedly rather short, it was considered undesirable to lengthen it, since by so doing all recently introduced varieties would have been kept too long from taking their place in the tables with the older sorts.

During the past season very dry weather prevailed in the Maritime Provinces during June and the greater part of July which considerably reduced the grain crops. The straw was short, but rains late in July brought the grain up to a fairly plump condition. The weather later in the season was favourable for roots. Better conditions for crop growing prevailed in Quebec and Ontario, but rust on the grain was general. Rust also was prevalent in some parts of Manitoba on wheat and oats, but in other respects the conditions were favourable. Pease gave a remarkably large return and the crop of roots was unusually heavy, while potatoes gave an enormous yield. At Indian Head all the cereal crops were good, but roots yielded less than usual; carrots gave a very small crop. At Agassiz, B. C., the crops were fairly satisfactory excepting roots which gave a small return.

The following lists include only those varieties which are being grown on all the Dominion Experimental Farms.

It frequently happens that a variety of grain is grown for one or two years at the Central Farm before being sent out to be tested at the branch farms. In all such cases, in order to secure uniformity in the tables in this bulletin, the yields at the Central Farm are only recorded for those years in which the varieties were grown on all the farms.

In computing the average for these tables the same five years have been used in each case, except in a few instances where the omission or failure of one of the plots made a blank in the records for that year. These instances are marked with a cross † and the true position in the tables of the varieties so marked is on this account to be regarded as somewhat uncertain.

* Cross-bred varieties produced on the Experimental Farms are marked with an asterisk.

SPRING WHEAT

Thirty-six varieties of spring wheat (exclusive of the macaroni wheats) have been grown on the uniform test plots at all the Dominion Experimental Farms during the past season. The size of the plots was one-fortieth of an acre at Ottawa, Ont., Nappan, N. S. and Agassiz, B. C.; while at Brandon, Man., and Indian Head, N. W. T., the plots were one-twentieth of an acre. The seed was sown at the rate of one and one-half bushels per acre. The dates of sowing were as follows:—At Ottawa, April 27 and May 2; Nappan, May 12; Brandon, May 4; Indian Head, April 29; and at Agassiz, April 25.

In Canada the bushel of wheat is 60 lbs.

SPRING WHEAT—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston *	35	33	115	29	20	15	Hungarian	33	14	117	24	2
2	Red Fife	35	9	119	30	57	16	Pringle's Champlain	33	5	116	25	17
3	Advance *	34	54	115	29	41	17	Percy *	32	55	115	26	29
4	Monarch	34	44	119	30	34	18	Colorado	32	50	116	24	5
5	White Fife	34	39	119	29	44	19	Plumper *	32	21	115	24	31
6	Huron *	34	37	117	25	57	20	Dawn *	32	17	114	25	25
7	White Russian	34	30	120	30	14	21	Herisson Bearded	32	15	118	23	57
8	Rio Grande	34	8	118	23	53	22	Weldon *	32	13	118	28	2
9	Wellman's Fife	34	2	119	28	10	23	Byron *	32	4	114	28	45
10	Clyde *	33	56	117	27	24	24	Crawford *	31	57	113	26	44
11	Laurel *	33	54	120	27	50	25	Countess *	31	55	115	27	13
12	Admiral *	33	50	117	29	54	26	Early Riga *	30	28	109	24	37
13	Stanley *	33	31	116	27	25	27	Fraser *	29	39	111	22	31
14	Red Fern	33	26	118	26	3							

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Power's Fife=Minn. 149 (4 years)	33	55	120	30	2	Hastings * (4 years)	32	6	115	25	30
Benton * (4 years)	33	26	116	30	19	Australian No. 19 (4 years)	31	31	120	28	24
Chester * (4 years)	32	59	116	29	38	Australian No. 9 (4 years)	31	4	118	28	36
McKendry's Fife=Minn 181 (4 years)	32	36	120	25	10	Haynes' Blue Stem=Minn 169 (4 years)	30	34	121	25	56
Minnesota No. 163 (4 years)	32	27	120	27	22						

The average crop of the thirty-six varieties of spring wheat tested on all the Experimental Farms in 1904 was 28 bus. 2 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston *	31	24	107	21	20	15	Hungarian	27	22	110	14	..
2	Huron *	30	20	110	12	20	16	Monarch	27	18	114	18	40
3	Herisson Bearded	29	44	110	23	..	17	Wellman's Fife	27	18	113	14	20
4	Pringle's Champlain	29	16	108	19	..	18	Weldon *	26	52	110	26	20
5	Advance *	29	..	109	23	40	19	Colorado	26	44	107	19	40
6	White Fife	28	34	112	18	..	20	Rio Grande	26	34	112	16	20
7	Red Fern	28	26	110	22	40	21	Crawford *	26	20	104	20	20
8	Clyde *	28	14	110	21	..	22	Percy *	26	20	107	18	..
9	Red Fife	28	6	113	15	..	23	Dawn *	25	12	107	18	20
10	Plumper *	28	..	106	23	..	24	Countess *	24	48	106	19	40
11	Byron *	27	54	107	27	20	25	Stanley *	24	..	107	16	40
12	White Russian	27	54	113	17	..	26	Fraser *	23	56	101	16	40
13	Admiral *	27	42	110	25	..	27	Early Riga *	20	52	101	17	..
14	Laurel *	27	34	112	21	20							

SPRING WHEAT—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.—*Con.*

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Hastings * (4 years)	28	52	107	25	20	Chester * (4 years)	25	17	108	24	40
McKendry's Fife (Minn. 181) (4 years)	28	15	112	16	40	Haynes' Blue Stem = Minn 169 (4 years)	24	15	114	12	40
Benton (4 years) *	28	10	110	23	40	Power's Fife = Minn. 149 (4 years)	24	..	113	16	20
Australian No. 19 (4 years)	27	2	113	16	40	Australian No. 9 (4 years)	19	2	109	11	20
Minnesota No. 163 (4 years)	26	15	113	15	40						

The average crop of the thirty-six varieties of spring wheat tested on the Central Experimental Farm in 1904 was 19 bus. 8 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Rio Grande	37	20	113	27	..	15	Admiral *	33	20	114	26	40
2	White Fife	36	16	116	27	20	16	Red Fern	33	20	113	22	40
3	Red Fife	35	28	114	28	..	17	Plumper. *	32	44	113	24	20
4	Laurel *	35	16	116	22	20	18	Crawford *	32	24	113	24	..
5	Byron *	35	12	113	28	40	19	Pringle's Champlain	32	8	112	22	..
6	Advance *	35	8	112	21	40	20	Huron *	32	4	113	24	..
7	White Russian	34	56	115	26	..	21	Weldon *	32	..	115	20	40
8	Clyde *	34	48	114	21	20	22	Herisson Bearded	31	52	114	23	20
9	Hungarian	34	40	113	21	20	23	Dawn *	31	12	113	24	40
10	Preston *	34	40	113	26	..	24	Percy *	31	8	113	18	20
11	Wellman's Fife	34	32	116	25	20	25	Stanley *	30	44	114	20	20
12	Colorado	34	24	112	24	40	26	Countess *	28	40	114	23	20
13	Early Riga *	33	48	108	24	20	27	Fraser *	24	40	113	20	..
14	Monarch	33	48	115	24	20							

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Chester * (4 years)	32	35	115	23	..	Benton * (4 years)	29	..	116	25	20
Power's Fife (4 years)	30	10	117	22	40	Australian No. 9 (4 years)	28	20	119	26	
McKendry's Fife (4 years)	29	30	118	20	..	Haynes' Blue Stem (4 years)	26	25	118	21	40
Hastings * (4 years)	29	10	116	24	..	Australian No. 19 (4 years)	24	5	119	21	
Minnesota No. 163 (4 years)	29	10	118	20	..						

The average crop of the thirty-six varieties of spring wheat tested on the Experimental Farm at Nappan in 1904 was 23 bus. 31 lbs. per acre.

SPRING WHEAT—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Monarch	34	4	119	33	40	15	Fraser *	30	20	110	31	..
2	Dawn *	34	..	113	29	..	16	Countess *	30	18	117	25	20
3	White Fife	33	32	120	31	20	17	Preston *	30	16	115	33	..
4	Advance *	33	30	114	31	..	18	Pringle's Champlain	30	10	115	31	20
5	Red Fife	33	26	120	36	40	19	Hungarian	29	44	117	29	20
6	White Russian	33	16	120	26	40	20	Percy *	29	42	112	26	20
7	Admiral *	33	8	117	29	40	21	Rio Grande	29	38	117	19	40
8	Laurel *	32	36	120	25	20	22	Weldon *	29	32	117	26	20
9	Huron *	32	28	115	31	20	23	Red Fern	28	50	116	23	20
10	Wellman's Fife	32	18	118	26	20	24	Herisson Bearded	28	50	115	22	20
11	Clyde *	31	52	117	26	..	25	Early Riga *	28	40	108	28	..
12	Crawford *	31	48	114	36	..	26	Plumper *	28	28	116	23	20
13	Stanley *	31	32	116	26	20	27	Colorado *	27	8	115	22	..
14	Byron *	30	24	114	27	40							

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Australian No. 9 (4 years)	32	45	117	36	40	Haynes' Blue Stem (4 years)	27	15	120	27	..
Benton * (4 years)	32	..	114	31	20	Australian No. 19 (4 years)	26	..	121	36	..
Power's Fife (4 years)	31	52	120	35		Hastings * (4 years)	25	55	116	27	..
Chester * (4 years)	30	10	117	34		McKendry's Fife (4 years)	22	7	119	16	20
Minnesota No. 163 (4 years)	27	40	110	25	40						

The average crop of the thirty-six varieties of spring wheat tested on the Experimental Farm at Brandon in 1904 was 28 bus. 32 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days muturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston *	44	26	125	39	40	15	White Russian	39	52	129	48	50
2	Stanley *	43	51	124	42	25	16	Admiral *	39	48	123	38	10
3	Huron *	43	21	123	36	5	17	Clyde *	39	34	124	41	50
4	Red Fern	43	19	128	38	45	18	Colorado	39	22	125	31	5
5	Monarch	42	36	127	50	20	19	White Fife	39	1	128	38	40
6	Percy *	42	23	124	41	5	20	Herisson Bearded	38	27	129	28	55
7	Weldon *	42	12	126	40	20	21	Dawn *	38	21	121	34	25
8	Rio Grande	41	55	129	32	45	22	Laurel *	38	6	130	42	50
9	Wellman's Fife	41	52	129	42	50	23	Plumper *	36	32	122	27	50
10	Red Fife	41	31	129	43	5	24	Fraser *	35	42	118	27	35
11	Pringle's Champlain	41	5	127	31	25	25	Crawford *	35	35	119	30	..
12	Advance *	40	57	128	49	45	26	Early Riga *	34	55	116	35	45
13	Hungarian	40	38	127	29	50	27	Byron *	34	25	119	27	40
14	Countess *	40	19	121	40	5							

SPRING WHEAT—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Power's Fife (4 years)....	44	27	129	48	40	Chester * (4 years).....	39	11	124	41	10
McKendry's Fife(4 years)	42	9	130	45	30	Hastings * (4 years).....	38	52	124	32	30
Australian No. 19 (4 years).....	41	51	129	44	20	Benton * (4 years).....	38	26	123	42	15
Minnesota No. 163 (4 years)..	41	30	130	45	20	Australian No. 9 (4 years)	38	5	127	41	40
						Haynes' Blue Stem (4 years).....	37	59	131	40	..

The average crop of the thirty-six varieties of spring wheat tested on the Experimental Farm at Indian Head in 1904 was 38 bush. 42 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B. C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested. for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Stanley *.....	37	26	118	31	20	15	Percy *.....	35	3	118	28	40
2	Red Fife..... ...	37	15	120	32	..	16	Huron *.....	34	50	122	26	..
3	Preston *.....	36	59	116	26	40	17	Wellman's Fife	34	10	121	32	..
4	Colorado.....	36	34	119	23	..	18	Early Riga *.	34	3	112	18	..
5	White Russian.....	36	34	122	32	40	19	Hungarian.....	33	44	119	25	40
6	Laurel *..... ...	36	..	121	27	20	20	Fraser *.....	33	37	114	17	20
7	Plumper *...	35	59	118	24	20	21	Crawford *.....	33	36	114	23	20
8	Monarch.....	35	54	120	25	50	22	Red Fern.....	33	15	121	22	50
9	White Fife.....	35	53	119	33	20	23	Pringle's Champlain..	32	48	120	22	40
10	Advance *.....	35	53	114	22	20	24	Dawn *.....	32	38	117	20	40
11	Countess *.....	35	31	117	27	40	25	Byron *.....	32	25	115	27	..
12	Rio Grande.....	35	15	121	23	40	26	Herisson Bearded....	32	21	121	22	..
13	Clyde *.....	35	14	119	26	50	27	Weldon *.....	30	30	121	26	30
14	Admiral *..... ...	35	10	120	30	..							

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
McKendry's Fife(4 years)	40	57	122	27	20	Hastings * (4 years).....	37	39	114	18	40
Benton * (4 years)	39	32	119	29	..	Chester * (4 years).....	37	20	117	25	20
Power's Fife (4 years)...	39	7	121	27	30	Australian No. 9 (4 years)..... .	37	10	119	27	10
Australian N. 19 (4 years)	38	39	117	24	..	Haynes Blue Stem (4 years).....	36	57	121	28	20
Minnesota No. 163 (4 years).....	37	40	121	30	10						

The average crop of the thirty-six varieties of spring wheat tested on the Experimental Farm at Agassiz in 1904 was 26 bus.2 lbs. per acre.

SPRING WHEAT—*Continued.*

NOTE ON THE MILLING VALUE OF CERTAIN VARIETIES OF WHEAT.

The following varieties of spring wheat which have proved very productive at one or more of the experimental farms do not give flour of the best quality for bread making and should not, therefore, be grown for ordinary milling purposes :—

Rio Grande.
Herisson Bearded.
Colorado.

MACARONI WHEAT.

It has been thought best to publish the results of the tests of varieties of macaroni wheat in a separate table, rather than in conjunction with the ordinary sorts of spring wheat. While it is possible to make good flour from some kinds of macaroni wheat, such flour is generally unpopular. Furthermore the peculiar character of the kernels necessitates the use of somewhat different methods in the milling of these kinds of wheat. They are naturally, therefore, looked upon with disfavour by millers.

Farmers who grow any of these varieties should exercise great care to prevent them from becoming mixed with the standard sorts used for flour making.

Four varieties of macaroni wheat have been grown on the uniform test plots during the past season. The plots were of the same size as those sown with ordinary spring wheat and the seed was used at the rate of one and three-quarter bushels per acre. The dates of sowing were as follows :—At Ottawa, Ont., May 2 ; Nappan, N. S., May 12 ; Brandon, Man., May 4 ; Indian Head, N. W. T., April 29 ; and at Agassiz, B. C., April 25th.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Average yield for 1904.		Varieties tested for less than five years.			Average days maturing.	Average yield for 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
1	Roumanian.....	39	10	121	34	26	YellowGharnovka (1 yr).	..	..	116	31	45
2	Goose.....	37	32	119	35	25	Mahmoudi (1 year).....	..	..	116	30	2

The average crop of the four varieties of macaroni wheat tested on all the Experimental Farms in 1904 was 32 bus. 54 lbs. per acre.

MACARONI WHEAT—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number	Varieties tested for five years.	Average yield for five years.	Average days maturing.	Yield for 1904	Varieties tested for less than five years.		Days maturing.	Yield for 1904.
		Bu. Lbs.	Days.	Bu. Lbs.		Bu. Lbs.	Days.	Bu. Lbs.
1	Roumanian.....	32 38	113	39 40	Yellow Gharnovka (1 yr)	.. ..	105	31 20
2	Goose	27 41	111	35 20	Mahmoudi (1 year).....	.. ..	105	26 ..

The average crop of the four varieties of macaroni wheat tested on the Central Experimental Farm in 1904 was 33 bus. 5 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.	Average days maturing.	Yield for 1904.	Varieties tested for less than five years.		Days maturing.	Yield for 1904.
		Bu. Lbs.	Days.	Bu. Lbs.		Bu. Lbs.	Days.	Bu. Lbs.
1	Roumanian.....	34 24	118	13 20	Yellow Gharnovka (1 yr)	.. ..	104	14 ..
2	Goose.....	30 40	116	16 ..	Mahmoudi (1 year).....	.. ..	104	8 ..

The average crop of the four varieties of macaroni wheat tested on the Experimental Farm at Nappan in 1904 was 12 bus. 50 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.	Average days maturing.	Yield for 1904.	Varieties tested for less than five years.		Days maturing	Yield for 1904.
		Bu. Lbs.	Days.	Bu. Lbs.		Bu. Lbs.	Days.	Bu. Lbs.
1	Goose.....	47 20	121	53 20	Yellow Gharnovka (1 yr)	.. ..	128	45 ..
2	Roumanian	45 16	121	45 20	Mahmoudi (1 year).....	.. ..	128	44 40

The average crop of the four varieties of macaroni wheat tested on the Experimental Farm at Brandon in 1904 was 47 bus. 5 lbs. per acre.

MACARONI WHEAT—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT INDIAN HEAD, N. W. T.

Number.	Varieties tested for five years.	Average yield for five years.	Average days maturing.	Yield for 1904.	Varieties tested for less than five years.		Days maturing.	Yield for 1904.
		Bu. Lbs.	Days.	Bu. Lbs.		Bu. Lbs.	Days.	Bu. Lbs.
1	Roumanian.	45 30	129	47 50	Mahmoudi (1 year).....	.. ..	127	43 30
2	Goose.....	45 7	128	43 5	Yellow Gharnovka (1 yr)	.. ..	129	41 45

The average crop of the four varieties of macaroni wheat tested on the Experimental Farm at Indian Head in 1904 was 44 bushels 2 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT AGASSIZ, B. C.

Number.	Varieties tested for five years.	Average yield for five years.	Average days maturing.	Yield for 1904.	Varieties tested for less than five years.		Days maturing.	Yield for 1904.
		Bu. Lbs.	Days.	Bu. Lbs.		Bu. Lbs.	Days.	Bu. Lbs.
1	Roumanian.....	38 —	122	26 —	Mahmoudi (1 year).....	.. ..	114	28 ..
2	Goose.....	36 50	120	29 20	Yellow Gharnovka (1 yr)	.. ..	116	26 40

The average crop of the four varieties of macaroni wheat tested on the Experimental Farm at Agassiz in 1904 was 27 bushels 30 lbs. per acre.

EMMER AND SPELT.

Two varieties of emmer and two of spelt were sown in the uniform test plots this season. In previous years only Common Emmer (incorrectly called 'Speltz') was grown; so that for purposes of comparison the only figures available are those of the present season. The varieties are therefore arranged in the tables in the order of their yield for this year.

The plots were of the same size as those of spring wheat. The dates of sowing were as follows:—At Ottawa, Ont., May 3; Nappan, N.S., May 12; Brandon, Man., May 4; Indian Head, N.W.T., May 14; and at Agassiz, B.C., April 25.

The yield is expressed in pounds per acre, the grain being, of course, weighed with the husk adhering.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	——	Average yield for 1904.	Average days maturing.	Number.	——	Average Yield for 1904.	Average Days maturing.
		Lbs.				Lbs.	
1	Common Emmer	2448	113	3	Red Spelt.....	1808	118
2	Red Emmer.....	1980	118	4	White Spelt..... ..	1362	117

EMMER AND SPELT—*Continued*

YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	——	Yield for 1904.	Days maturing.	Number.	——	Yield for 1904.	Days maturing.
		Lbs.				Lbs.	
1	Red Emmer.....	2760	108	3	Common Emmer.....	2040	101
2	Red Spelt.....	2240	109	4	White Spelt.....	1740	104

YIELD ON THE EXPERIMENTAL FARM AT NAPPAN, N.S.

Number.	——	Yield for 1904.	Days maturing.	Number.	——	Yield for 1904.	Days maturing.
		Lbs.				Lbs.	
1	Red Spelt.....	1400	110	3	Common Emmer	1040	102
2	White Spelt.....	1120	110	4	Red Emmer.....	1000	110

YIELD ON THE EXPERIMENTAL FARM AT BRANDON, MAN.

Number.	——	Yield for 1904.	Days maturing.	Number.	——	Yield for 1904.	Days maturing.
		Lbs.				Lbs.	
1	Common Emmer.....	4140	128	3	Red Spelt.....	2000	131
2	Red Emmer.....	2780	133	4	White Spelt.....	1240	129

YIELD ON THE EXPERIMENTAL FARM AT INDIAN HEAD, N.W.T.

Number.	——	Yield for 1904.	Days. maturing.	Number.	——	Yield for 1904.	Days. maturing.
		Lbs.				Lbs.	
1	Common Emmer.....	3100	118	3	Red Emmer.....	1520	121
2	Red Spelt.....	1720	123	4	White Spelt.....	1120	123

YIELD ON THE EXPERIMENTAL FARM AT AGASSIZ, B.C.

Number.	——	Yield for 1904.	Days. maturing.	Number.	——	Yield for 1904.	Days maturing.
		Lbs.				Lbs.	
1	Common Emmer.....	1920	117	3	Red Spelt	1680	119
2	Red Emmer.....	1840	117	4	White Spelt.....	1590	117

OATS.

During the season of 1904, forty-two varieties of oats have been under trial. The size of the plots on which they were grown was the same as in the case of spring wheat. The seed was generally sown at the rate of two bushels per acre, and the dates of sowing were as follows.—At Ottawa, Ont., May 6; Nappan, N. S., May 13; Brandon, Man., May 5; Indian Head, N. W. T., May 7; and at Agassiz, B. C.—April 16.

In Canada the bushel of oats is 34 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Banner	84	3	109	89	18	13	Bavarian	77	21	110	73	26
2	Abundance	82	2	110	82	7	14	Golden Giant	77	19	114	79	4
3	Lincoln	81	28	110	84	3	15	American Beauty	77	17	109	75	11
4	Holstein Prolific	81	9	109	74	33	16	Siberian	77	12	112	73	10
5	Danish Island	81	6	111	79	8	17	Golden Tartarian	77	6	115	72	20
6	Wide Awake	80	24	110	81	9	18	White Giant	77	2	110	82	10
7	Golden Beauty	79	21	111	82	5	19	Black Beauty	76	19	109	68	22
8	Buckbee's Illinois	78	25	111	72	32	20	Thousand Dollar	76	14	108	75	27
9	Early Golden Prolific	78	13	110	76	28	21	Mennonite	75	31	109	67	19
10	Columbus	78	10	110	78	23	22	Joanette	73	29	112	67	26
11	Improved American	78	8	110	76	11	23	Improved Ligowo	73	3	109	59	7
12	American Triumph	77	33	111	80	14							

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Irish Victor (4 years)	76	16	111	81	21	Milford White * (2 years)	79	12	112	76	4
Sensation (4 years)	76	1	109	68	29	Olive Black * (2 years)	77	3	115	69	18
Goldfinder (4 years)	75	15	114	74	24	Milford Black * (2 years)	76	31	113	76	3
Waverley (4 years)	74	28	110	73	17	Swedish Select (2 years)	76	27	111	66	5
Pioneer (4 years)	71	33	109	79	16	Kendal Black * (2 years)	76	23	114	74	6
Tartar King (4 years)	71	0	108	65	23	Pense Black * (2 years)	75	33	115	75	12
Scotch Potato (4 years)	68	2	112	74	12	Olive White * (2 years)	73	25	113	68	6
Twentieth Century (3 years)	85	2	112	80	30	Pense White * (2 years)	73	12	113	67	22
Kendal White * (2 years)	82	24	112	78	18	Storm King (1 year)	—	—	109	61	18
Golden Fleece (2 years)	82	16	112	80	10						

The average crop of the forty-two varieties of oats tested on all the Experimental Farms in 1904 was 74 bus. 31 lbs. per acre.

OATS—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	White Giant	69	2	108	71	6	13	Improved American	62	8	108	53	18
2	Mennonite	68	2	107	79	14	14	American Beauty	61	14	105	65	10
3	Holstein Prolific	67	19	108	73	18	15	Buckbee's Illinois	61	10	107	64	4
4	Lincoln	67	10	107	98	8	16	Danish Island	59	2	108	57	2
5	Banner	66	32	107	69	14	17	Joanette	58	32	111	41	6
6	Columbus †	66	10	108	..	..	18	Thousand Dollar	58	16	106	70	..
7	American Triumph	65	22	109	80	20	19	Early Golden Prolific	58	8	107	72	12
8	Wide Awake	64	30	108	89	14	20	Bavarian †	57	..	110	..	..
9	Golden Beauty	64	4	108	71	6	21	Improved Ligowo	56	24	106	42	12
10	Abundance	63	26	108	71	6	22	Siberian	53	30	110	31	6
11	Golden Giant	63	6	111	67	2	23	Golden Tartarian	53	2	113	31	26
12	Black Beauty	63	2	107	53	18							

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Sensation (4 years)	68	33	108	77	2	Swedish Select † (2 yrs.)	70	10	111	..	..
Irish Victor (4 years)	62	2	109	70	..	Kendal White * (2 yrs.)	68	28	109	70	20
Pioneer (4 years)	55	5	108	76	16	Kendal Black * (2 yrs.)	65	..	109	72	12
Goldfinder (4 years)	54	24	110	54	4	Golden Fleece † (2 yrs.)	64	12	111	..	..
Tartar King (4 years)	48	23	105	45	10	Milford Black † (2 yrs.)	60	30	109	70	20
Waverley (4 years)	47	4	109	25	10	Olive White * (2 yrs.)	57	2	109	53	18
Scotch Potato (4 years)	46	33	111	58	28	Pense White * (2 yrs.)	55	10	108	46	16
Twentieth Century (3 years)	79	7	110	93	18	Pense Black * (2 yrs.)	55	10	109	69	14
Milford White * (2 years)	72	12	107	85	10	Olive Black * (2 yrs.)	54	4	112	47	2
						Storm King (1 yr.)	..	..	105	20	40

The average crop of the forty-two varieties of oats tested on the Central Experimental Farm in 1904 was 62 bush. 31 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Lincoln	81	14	111	61	6	13	Wide Awake	76	..	109	61	6
2	Siberian	80	32	110	69	14	14	Improved Ligowo	75	17	108	56	16
3	Thousand Dollar	78	32	108	57	2	15	Golden Beauty	74	28	110	63	18
4	Danish Island	78	20	110	56	16	16	Improved American	74	20	110	60	.
5	Joanette	78	12	105	56	16	17	Abundance	74	12	108	58	28
6	Holstein Prolific	78	8	109	61	26	18	Golden Giant	74	8	114	60	20
7	Bavarian	78	20	109	56	16	19	American Beauty	73	30	109	56	16
8	Early Golden Prolific	77	30	109	55	10	20	Mennonite	73	22	111	45	30
9	Banner	77	18	107	64	4	21	Buckbee's Illinois	71	18	110	49	14
10	White Giant	76	32	113	60	..	22	Columbus	68	24	111	65	30
11	Black Beauty	76	32	103	51	26	23	American Triumph	65	12	113	44	24
12	Golden Tartarian	76	8	117	63	18							

OATS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.—*Cont.*

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Sensation (4 years)....	79	14	108	60	..	Golden Fleece (2 yrs.)....	75	10	107	68	8
Goldfinder (4 years).....	77	12	114	61	6	Olive Black * (2 yrs.).....	68	8	107	48	8
Pioneer (4 years).....	74	14	108	58	28	Milford Black * (2 yrs.)..	67	22	106	55	10
Waverley (4 years).. ...	70	5	106	60	20	Kendal White * (2 yrs.)..	65	10	106	55	10
Tartar King (4 years)...	69	24	106	50	20	Pense Black * (2 yrs.)....	65	10	107	49	14
Scotch Potato (4 years)..	66	26	111	54	4	Kendal Black * (2 yrs.)...	64	4	106	52	32
Irish Victor (4 years)...	65	20	109	62	12	Milford White * (2 yrs.)..	60	..	106	45	30
Twentieth Century (3 years)..	82	28	109	59	14	Pense White * (2 yrs.)....	58	28	107	48	8
						Olive White * (2 yrs.) ...	58	8	107	44	24
Swedish Select (2 years).	80	..	106	72	32	Storm King (1 yr.)	..	..	98	50	20

The average crop of the forty-two varieties of oats tested on the Experimental Farm at Nappan in 1904 was 57 bus. 1 lb. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Buckbee's Illinois....	101	2	108	121	26	13	Holstein Prolific. ...	92	24	104	100	20
2	Wide Awake.....	99	16	106	125	30	14	Columbus..	92	8	104	117	22
3	Abundance.....	98	26	106	130	20	15	Golden Giant	91	..	112	116	16
4	Siberian.	96	28	106	127	22	16	Golden Tartarian...	90	20	111	113	18
5	Danish Island.....	96	26	106	132	12	17	White Giant.....	90	10	105	121	26
6	Banner.....	96	10	105	131	6	18	Bavarian.....	90	10	105	115	30
7	Lincoln.....	96	4	106	127	22	19	Thousand Dollar.....	86	18	104	117	22
8	Early Golden Prolific.	95	29	106	127	2	20	Mennonite.....	85	30	102	90	..
9	American Triumph...	95	..	106	125	10	21	Joanette.....	81	32	109	107	22
10	Golden Beauty.....	94	28	106	132	32	22	Black Beauty.....	80	14	107	108	8
11	Improved American..	94	..	104	134	4	23	Improved Ligowo ‡..	76	6	103	58	8
12	American Beauty....	93	10	105	117	22							

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Waverley (4 years).....	92	25	106	122	32	Kendal White * (2 years).	100	..	110	108	8
Irish Victor (4 years)....	91	18	105	112	32	Olive White * (2 years)...	98	18	114	116	16
Goldfinder (4 years).....	80	22	110	111	26	Olive Black * (2 years). ..	95	30	114	103	18
Scotch Potato (4 years)..	79	14	107	119	14	Pense Black * (2 years)...	95	20	114	105	30
Sensation (4 years) . ..	78	33	105	79	14	Milford Black * (2 years).	95	15	114	103	18
Tartar King (4 years)...	76	13	104	105	30	Kendal Black * (2 years)..	93	18	114	104	24
Pioneer (4 years)..	75	5	106	107	2	Milford White * (2 years).	91	16	113	105	10
Twentieth Century (2 years).....	106	1	108	107	22	Pense White * (2 years)..	90	20	113	101	6
						Swedish Select ‡ (2 years).	74	4	105	54	4
Golden Fleece (2 years)..	102	2	106	120	..	Storm King (1 year).	..	..	113	90	..

‡ A considerable part of the crop was destroyed by birds.

The average crop of the forty-two varieties of oats tested on the Experimental Farm at Brandon in 1904 was 110 bushels 33 lbs. per acre.

OATS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Banner	114	28	111	123	28	13	Lincoln	96	30	110	75	25
2	Abundance	108	8	110	93	23	14	Golden Tartarian	96	..	116	101	26
3	Danish Island	104	22	110	98	28	15	Early Golden Prolific	95	22	111	78	28
4	Golden Beauty	103	31	110	93	3	16	Golden Giant	95	4	116	98	28
5	Wide Awake	101	29	109	75	5	17	Buckbee's Illinois	94	7	109	71	6
6	Improved American	101	5	111	76	1	18	Black Beauty	92	32	111	75	30
7	Holstein Prolific	100	25	110	78	13	19	Mennonite	92	18	109	71	26
8	American Beauty	100	1	111	86	11	20	Siberian	92	7	116	82	12
9	American Triumph	100	..	111	95	30	21	Joanette	91	18	115	79	14
10	Bavarian	99	28	111	83	18	22	Improved Ligowo	91	3	108	80	15
11	Columbus	99	5	112	94	19	23	White Giant	86	31	109	97	2
12	Thousand Dollar	97	17	108	73	3							

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Goldfinder (4 years)	101	16	115	97	22	Milford White * (2 years)	105	..	119	90	20
Irish Victor (4 years)	97	2	113	102	17	Pense Black * (2 years)	103	27	123	92	21
Waverley (4 years)	95	24	112	101	21	Swedish Select (2 years)	103	23	117	80	30
Sensation (4 years)	90	24	110	80	5	Golden Fleece (2 years)	101	18	122	82	7
Pioneer (4 years)	88	20	112	98	18	Pense White * (2 years)	101	6	120	87	2
Tartar King (4 years)	87	33	110	69	..	Kendal Black (2 years)	100	20	122	84	4
Scotch Potato (4 years)	84	28	113	87	22	Twentieth Century (2 years)	100	..	116	89	14
Kendal White * (2 years)	112	32	119	98	28	Olive White * (2 years)	89	20	116	69	26
Milford Black * (2 years)	108	1	122	101	13	Storm King (1 year)	..	..	113	93	19
Olive Black * (2 years.)	105	29	123	89	32						

The average crop of the forty-two varieties of oats tested on the Experimental Farm at Indian Head in 1904 was 87 bush. 23 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Golden Tartarian	69	32	120	52	12	13	Golden Giant	64	11	119	52	22
2	Black Beauty	69	16	115	53	28	14	American Triumph	63	30	118	55	20
3	Lincoln	67	12	118	57	22	15	Bavarian	63	2	117	56	6
4	Holstein Prolific	67	4	118	60	20	16	Siberian	62	30	119	55	30
5	Danish Island	66	30	119	51	16	17	Wide Awake	61	14	119	54	24
6	Improved Ligowo	66	..	118	58	18	18	Thousand Dollar	60	20	116	61	6
7	Buckbee's Illinois	65	8	120	58	8	19	Golden Beauty	60	15	119	50	..
8	Abundance	65	4	119	56	26	20	Mennonite	59	15	114	50	25
9	White Giant	65	2	118	61	16	21	Improved American	59	8	117	57	32
10	Columbus	65	2	116	50	10	22	American Beauty	58	32	119	50	30
11	Banner	64	28	116	59	4	23	Joanette	58	18	118	54	4
12	Early Golden Prolific	64	12	116	50	20							

OATS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.—*Cont.*

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield for 1904.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Tartar King (4 years)....	72	8	116	57	22	Milford White * (2 years).	67	32	117	53	18
Waverley (4 years).....	68	15	116	57	2	Kendal White * (2 years).	66	16	118	59	24
Pioneer (4 years).....	66	21	114	56	16	Olive White * (2 years)...	65	10	117	56	16
Irish Victor (4 years)....	66	6	118	60	10	Olive Black * (2 years)...	61	11	118	58	28
Goldfinder (4 years).....	63	..	119	48	28	Pense White * (2 years)..	60	30	116	55	10
Scotch Potato (4 years)..	62	12	119	51	26	Kendal Black * (2 years).	60	5	119	56	26
Sensation (4 years).....	62	4	116	47	22	Pense Black * (2 years)..	59	32	121	59	14
Twentieth Century (3 years).....	57	8	116	54	14	Swedish Select (2 years)..	55	32	115	52	27
Golden Fleece (2 years)..	69	4	110	67	2	Milford Black * (2 years).	52	17	116	49	24
						Storm King (1 year).....	..	..	114	52	32

The average crop of the forty-two varieties of oats tested on the Experimental Farm at Agassiz in 1904 was 55 bus. 14 lbs. per acre.

SIX ROWED BARLEY.

During the season of 1904, twenty varieties of six-rowed barley have been under test. The plots were of the same size at those sown with spring wheat. The seed was used in the proportion of two bushels to the acre; and the dates of sowing were as follows:—At Ottawa, Ont, May 5; Nappan, N.S., May, 24; Brandon, Man., May 17; Indian Head, N. W. T. May 14; and at Agassiz B. C. April 23.

In Canada the bushel of barley is 48 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mensury.....	54	44	96	50	46	11	Oderbruch.....	51	2	95	47	45
2	Odessa.....	54	10	95	52	38	12	Summit *.....	50	47	99	50	30
3	Common.....	52	9	95	50	8	13	Mansfield *.....	50	14	98	42	35
4	Yale *.....	51	42	99	53	30	14	Empire *.....	50	8	98	51	24
5	Claude *.....	51	38	98	53	32	15	Argyle *.....	49	26	97	50	32
6	Trooper *.....	51	33	98	47	45	16	Rennie's Improved...	49	3	95	47	5
7	Nugent *.....	51	30	99	50	40	17	Baxter	48	57	95	50	29
8	Brome*.....	51	29	99	54	6	18	Albert *.....	48	22	96	48	4
9	Royal *.....	51	15	96	46	44	19	Garfield *.....	47	26	98	48	9
10	Stella *.....	51	8	99	55	14	20	Champion (beardless).	41	18	93	35	17

The average crop of the twenty varieties of six-rowed barley tested on all the Experimental Farms in 1904 was 49 bus. 22 lbs. per acre.

SIX ROWED BARLEY—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Stella *	51	10	95	58	16	11	Royal *	42	44	96	34	8
2	Odessa	49	38	95	43	16	12	Albert *	42	10	96	36	12
3	Mensury	48	44	94	42	24	13	Oderbruch	42	6	96	36	32
4	Nugent *	47	10	96	50	..	14	Argyle *	41	30	97	43	16
5	Yale *	46	14	97	45	20	15	Rennie's Improved	41	18	94	40	..
6	Summit *	44	46	95	43	16	16	Claude *	41	2	97	43	16
7	Common	44	42	93	43	36	17	Empire *	39	46	96	41	12
8	Garfield *	43	30	96	40	40	18	Baxter	38	30	94	46	32
9	Trooper *	43	22	94	27	4	19	Champion †	34	44	94	22	24
10	Brome †*	43	18	96	37	24	20	Mansfield †	33	40	97	17	44

The average crop of the twenty varieties of six-rowed barley tested on the Central Experimental Farm in 1904 was 39 bus. 34 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Common	57	24	91	43	16	11	Stella *	49	32	98	45	40
2	Mensury	55	8	94	49	8	12	Nugent *	49	8	96	41	32
3	Oderbruch	53	40	91	45	40	13	Rennie's Improved	48	16	91	45	..
4	Trooper *	53	32	92	50	..	14	Brome *	48	6	97	44	8
5	Odessa	53	24	91	43	16	15	Mansfield *	48	..	96	37	24
6	Royal *	53	..	93	49	8	16	Garfield *	48	..	93	42	24
7	Baxter	51	32	91	39	8	17	Champion	46	16	90	38	16
8	Yale *	51	24	96	47	24	18	Argyle *	46	8	92	35	40
9	Albert *	50	40	91	40	4	19	Summit *	44	24	96	44	8
10	Empire *	49	40	95	45	..	20	Claude *	44	8	93	41	32

The average crop of the twenty varieties of six-rowed barley tested on the Experimental Farm at Nappan in 1904 was 43 bus. 22 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mansfield *	58	18	91	52	24	11	Odessa	51	14	91	57	24
2	Yale *	58	13	93	62	24	12	Stella *	50	40	94	53	16
3	Summit *	56	14	94	52	44	13	Oderbruch	50	24	90	41	32
4	Claude *	54	13	94	55	40	14	Common	50	24	89	42	44
5	Argyle *	54	4	92	54	28	15	Baxter	49	42	90	53	16
6	Mensury	53	44	92	47	4	16	Royal *	49	30	90	46	12
7	Brome *	53	36	94	66	32	17	Albert *	49	23	89	46	32
8	Empire *	53	20	94	58	36	18	Rennie's Improved	48	24	89	43	16
9	Nugent *	53	14	94	47	24	19	Garfield *	47	12	92	52	24
10	Trooper *	53	8	95	54	28	20	Champion	34	..	88	21	32

The average crop of the twenty varieties of six-rowed barley tested on the Experimental Farm at Brandon in 1904 was 50 bus. 20 lbs. per acre.

SIX ROWED BARLEY—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Claude *	66	44	99	66	32	11	Common	57	20	96	64	28
2	Odessa	65	36	97	62	24	12	Nugent *	57	16	103	67	24
3	Summit *	60	24	101	61	42	13	Stella *	56	7	99	65	20
4	Mansfield *	60	17	97	57	..	14	Argyle *	55	44	97	64	28
5	Royal *	60	8	97	58	36	15	Yale *	54	38	100	64	8
6	Trooper *	59	32	97	57	..	16	Oderbruch	54	33	95	57	19
7	Mensury	59	26	97	53	26	17	Garfield *	54	7	100	53	41
8	Empire *	58	44	100	57	4	18	Baxter	52	37	96	59	13
9	Brome *	58	3	100	60	40	19	Albert *	49	16	97	53	36
10	Rennie's Improved	57	31	96	62	9	20	Champion	43	15	93	41	7

The average crop of the twenty varieties of six-rowed barley tested on the Experimental Farm at Indian Head in 1904 was 59 bus. 22 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield for 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mensury	57	..	105	62	24	11	Argyle *	49	46	107	55	..
2	Brome *	54	38	108	57	24	12	Baxter	49	42	103	54	28
3	Oderbruch	54	4	103	58	6	13	Rennie's Improved	49	24	106	45	..
4	Claude *	52	30	107	60	40	14	Empire *	48	36	107	55	20
5	Nugent *	51	4	108	47	24	15	Summit *	48	30	109	50	40
6	Royal *	50	42	105	46	12	16	Yale *	48	24	110	48	26
7	Mansfield *	50	41	108	48	36	17	Trooper *	48	23	111	50	50
8	Odessa	50	34	103	57	14	18	Champion	48	16	101	53	6
9	Common	50	33	106	56	12	19	Stella *	48	..	112	53	26
10	Albert *	50	24	107	63	36	20	Garfield *	44	33	107	51	12

The average crop of the twenty varieties of six-rowed barley tested on the Experimental Farm at Agassiz in 1904 was 53 bus. 41 lbs. per acre.

TWO-ROWED BARLEY.

Fifteen varieties of two-rowed barley were tested, during the season of 1904, on all the Experimental Farms. The plots were of the same size as those of spring wheat. The seed was used at the rate of two bushels per acre; and the dates of sowing were as follows:—At Ottawa, Ont., May 4; Nappan, N.S., May 24; Brandon, Man., June 6; Indian Head, N.W.T., May 14; and at Agassiz, B.C., April 23.

In Canada the bushel of barley is 48 lbs.

TWO ROWED BARLEY—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	French Chevalier....	51	14	104	48	32	7	Logan *.....	45	25	100	45	45
2	Danish Chevalier....	50	8	104	52	..	8	Harvey *.....	45	16	100	43	47
3	Canadian Thorpe.....	49	11	102	46	38	9	Clifford *	44	41	99	44	12
4	Beaver *.....	48	26	101	45	29	10	Newton.....	44	33	103	36	10
5	Dunham *.....	46	23	100	42	15	11	Jarvis *.....	44	13	98	42	23
6	Sidney *.....	46	3	99	44	40	12	Fulton *.....	42	45	100	45	5
	Varieties tested for less than five years.	Average yield for less than five years.						Varieties tested for less than five years.	Average yield for less than five years.				
	Standwell (4 years).....	51	40	105	51	13		Gordon * (4 years).....	46	3	99	45	7
	Invincible (4 years).. ...	47	4	103	49	2							

The average crop of the fifteen varieties of two-rowed barley tested on all the Experimental Farms in 1904 was 45 bus. 21 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	French Chevalier	53	38	99	44	8	7	Newton.	40	8	100	33	36
2	Canadian Thorpe	51	18	99	44	8	8	Sidney *.....	38	40	98	30	20
3	Danish Chevalier	46	28	100	32	44	9	Logan *.....	38	38	101	20	..
4	Beaver *.....	45	18	96	31	32	10	Fulton *.....	38	30	99	32	44
5	Jarvis *.....	41	42	96	35	40	11	Dunham *.....	37	10	100	15	..
6	Clifford *.....	41	26	98	32	24	12	Harvey *.....	36	26	101	29	28
	Varieties tested for less than five years.	Average yield for less than five years.						Varieties tested for less than five years.	Average yield for less than five years.				
	Gordon * (4 years).....	42	36	98	39	28		Invincible (4 years).....	39	33	101	36	32
	Standwell (4 years).....	42	16	100	41	32							

The average crop of the fifteen varieties of two-rowed barley tested on the Central Experimental Farm in 1904 was 33 bus. 19 lbs. per acre.

TWO ROWED BARLEY—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N. S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Danish Chevalier.....	57	..	97	57	24	7	Logan *.....	41	..	97	41	32
2	Beaver *.....	53	32	95	42	24	8	Sidney *	40	26	97	32	24
3	French Chevalier.....	52	8	97	45	40	9	Clifford *.....	40	2	96	35	10
4	Newton.....	46	32	97	26	32	10	Harvey *.....	40	..	97	36	32
5	Canadian Thorpe.....	45	24	99	22	24	11	Fulton *.....	36	4	98	32	4
6	Dunham *.....	41	32	97	44	8	12	Jarvis *.....	31	4	96	21	32
	Varieties tested for less than five years.	**Average yield for less than five years.**						**Varieties tested for less than five years.**	**Average yield for less than five years.**				
	Standwell (4 years).....	43	6	99	27	24		Gordon (4 years) *.....	36	22	97	21	32
	Invincible (4 years).....	40	28	98	31	24							

The average crop of the fifteen varieties of two-rowed barley tested on the Experimental Farm at Nappan in 1904 was 34 bushels 31 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Dunham *	53	2	94	56	32	7	Sidney *.....	44	16	91	55	40
2	Logan*	49	28	95	52	24	8	Beaver *.....	42	36	95	52	24
3	Harvey *.....	49	23	93	55	40	9	French Chevalier.....	42	30	98	42	44
4	Fulton *.....	47	44	92	59	28	10	Canadian Thorpe.....	40	24	97	55	20
5	Jarvis *.....	47	26	90	55	40	11	Newton.....	39	30	98	30	20
6	Clifford *.....	46	24	92	58	36	12	Danish Chevalier....	37	44	99	53	36
	Varieties tested for less than five years.	**Average yield for less than five years.**						**Varieties tested for less than five years.**	**Average yield for less than five years.**				
	Gordon * (3 years).....	45	30	94	63	36		Invincible (3 years).....	41	39	94	63	36
	Standwell (3 years).....	42	1	96	63	36							

The average crop of the fifteen varieties of two-rowed barley tested on the Experimental Farm at Brandon in 1904 was 54 bushels 36 lbs. per acre.

TWO ROWED BARLEY—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Danish Chevalier....	60	26	110	59	8	7	Harvey *.....	52	35	97	49	23
2	French Chevalier.....	59	18	110	58	16	8	Logan *.....	51	13	98	47	29
3	Sidney *.....	59	9	97	48	46	9	Fulton *.....	50	35	98	50	45
4	Canadian Thorpe.....	57	6	104	55	40	10	Beaver *..	50	9	106	50	45
5	Jarvis *.....	53	37	98	46	27	11	Newton.....	49	22	108	40	..
6	Clifford *...	53	..	98	48	46	12	Dunham *.....	48	33	99	46	27

Varieties tested for less than five years.	Average yield for less than five years.				Varieties tested for less than five years.	Average yield for less than five years.			
Standwell (4 years).....	67	44	109	67 9	Gordon * (4 years).....	53	5	98	49 23
Invincible (4 years).....	64	25	108	67 4					

The average crop of the fifteen varieties of two-rowed barley tested on the Experimental Farm at Indian Head in 1904 was 52 bus. 23 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Canadian Thorpe....	51	42	113	56	2	7	Sidney *.....	47	22	114	56	22
2	Dunham *.....	51	38	111	49	8	8	Newton..	47	18	111	50	10
3	Beaver *...	50	36	112	50	20	9	Jarvis *.....	47	4	109	52	24
4	Danish Chevalier...	48	36	113	56	32	10	Logan *.....	47	..	110	67	44
5	French Chevalier ..	48	26	114	52	4	11	Clifford *.....	43	10	109	45	40
6	Harvey *.....	47	42	110	48	16	12	Fulton *.....	41	14	112	50	..

Varieties tested for less than five years.	Average yield for less than five years.				Varieties tested for less than five years.	Average yield for less than five years.			
Standwell (4 years).....	54	12	115	56 12	Invincible.....	48	38	113	46 12
Gordon * (4 years)	52	20	110	51 12					

The average crop of the fifteen varieties of two-rowed barley tested on the Experimental Farm at Agassiz in 1904 was 52 bus. 30 lbs. per acre.

PEASE.

Thirty-one varieties of pease have been under trial at all the Experimental Farms during the past season. The plots were of the same size as those sown with spring wheat. The quantity of seed used per acre varied from two to three bushels, depending on the size of the pea. The dates of sowing were as follows:—At Ottawa, Ont., May 4; Nappan, N.S., May 28; Brandon, Man., May 11; Indian Head, N.W.T., May 16; and at Agassiz, B.C., April 14.

In Canada the bushel of pease is 60 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Crown	38	34	115	41	20	17	White Wonder	36	45	113	39	46
2	Early Britain	38	28	114	42	4	18	Prussian Blue	36	42	115	43	4
3	Pride	38	24	116	43	28	19	Nelson *	36	37	114	41	48
4	Arthur *	38	16	114	44	12	20	Mummy	36	33	117	42	..
5	Macoun *	38	10	120	42	42	21	German White	36	27	114	42	14
6	Agnes *	37	44	116	43	58	22	Pearl *	36	23	120	41	44
7	Archer *	37	43	119	45	32	23	Wisconsin Blue	36	23	118	41	4
8	Mackay *	37	40	118	47	26	24	White Marrowfat	36	15	119	44	24
9	Prince *	37	36	117	47	12	25	Gregory *	36	14	118	41	24
10	Picton *	37	31	115	47	54	26	Victoria *	36	6	121	43	52
11	Daniel O'Rourke	37	31	113	46	.	27	Chancellor	36	4	113	38	48
12	King *	37	22	117	46	2	28	Kent. *	35	34	120	41	16
13	English Grey	37	21	117	40	54	29	Duke *	35	27	118	40	14
14	Golden Vine	37	6	115	45	14	30	Prince Albert	35	17	118	41	20
15	Paragon*	36	58	116	41	42	31	Black-eyed Marrowfat	35	6	117	40	48
16	Carleton *	36	58	118	44	38							

The average crop of the thirty-one varieties of pease tested on all the Experimental Farms in 1904 was 43 bush. 2 lbs. per acre.

PEASE—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Golden Vine	36	48	111	42	20	17	Early Britain	30	40	112	27	20
2	Prince *	33	48	113	42	..	18	White Wonder	30	36	107	37	40
3	Kent *	33	44	113	36	40	19	Pride	30	24	111	26	..
4	Paragon *	33	12	107	21	40	20	Archer *	30	12	115	41	20
5	Prussian Blue	33	12	110	38	20	21	Crown	30	12	111	26	..
6	Mackay *	32	20	111	45	40	22	Mummy	30	12	114	29	40
7	English Grey	32	12	112	29	20	23	Wisconsin Blue	29	56	113	35	20
8	Victoria *	32	4	116	45	..	24	White Marrowfat	29	28	112	33	20
9	Chancellor	32	..	106	30	..	25	Pearl *	29	16	113	23	..
10	Nelson*	31	52	108	38	40	26	Gregory*	29	4	112	34	..
11	Daniel O'Rourke	31	44	108	34	..	27	Agnes *	29	..	111	37	20
12	King *	31	32	113	39	40	28	Black-eyed Marrowfat	28	32	114	31	..
13	Arthur *	31	24	109	29	40	29	Macoun *	27	24	114	32	..
14	Picton *	31	20	112	41	..	30	German White	26	52	109	34	40
15	Prince Albert	31	16	113	41	20	31	Carleton *	26	36	113	22	..
16	Duke *	30	52	112	25	..							

The average crop of the thirty-one varieties of pease tested on the Central Experimental Farm in 1904 was 33 bus. 54 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Agnes *	35	12	112	34	..	17	English Grey	28	..	113	21	20
2	Archer *	34	56	112	33	20	18	White Marrowfat	27	44	112	28	..
3	Crown	33	28	110	27	20	19	Duke *	26	56	112	26	40
4	Arthur *	33	12	110	24	..	20	German White	26	56	110	26	..
5	Nelson *	32	32	109	33	20	21	Pearl *	26	40	115	24	40
6	Macoun *	31	4	114	31	20	22	Picton *	26	28	110	29	20
7	Pride	30	40	111	30	40	23	Kent *	26	8	114	22	40
8	Carleton *	30	..	113	36	..	24	Golden Vine	26	8	109	31	20
9	Prince Albert	29	36	112	36	40	25	King *	26	..	110	32	..
10	Chancellor	29	28	108	26	40	26	Early Britain	26	..	108	20	40
11	Mackay *	29	20	114	28	..	27	Wisconsin Blue	25	44	112	24	..
12	Gregory *	29	12	114	28	40	28	Prince *	25	28	110	29	20
13	Victoria *	28	56	117	30	40	29	Prussian Blue	24	24	109	19	20
14	Mummy	28	48	111	22	40	30	Paragon *	22	56	110	20	..
15	Daniel O'Rourke	28	32	110	23	20	31	White Wonder	22	32	108	12	40
16	Black-eyed Marrowfat	28	..	113	25	20							

The average crop of the thirty-one varieties of pease tested on the Experimental Farm at Nappan in 1904 was 27 bush. 5 lbs. per acre.

PEASE—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Macoun *	52	52	127	79	40	17	German White	44	42	120	50	20
2	Victoria *	50	14	128	71	40	18	Pride	44	24	122	64	20
3	King *	49	48	124	75	..	19	White Marrowfat	44	..	130	68	20
4	Pearl *	48	42	129	73	20	20	English Grey	43	46	127	60	..
5	Archer *	48	12	125	64	..	21	Prince Albert	43	20	126	60	40
6	Wisconsin Blue	48	12	121	57	20	22	Prussian Blue	43	6	119	58	..
7	Mackay *	48	..	124	85	..	23	Daniel O'Rourke	42	50	121	67	..
8	Golden Vine	47	26	119	66	20	24	Kent *	42	40	127	61	20
9	Early Britain	47	26	118	71	..	25	Prince *	42	28	127	63	20
10	Mummy	47	22	124	73	..	26	Gregory *	42	20	124	70	..
11	Picton *	47	20	121	77	10	27	Nelson *	41	46	116	57	40
12	Carleton *	46	52	123	73	50	28	Agnes *	41	30	120	56	..
13	White Wonder	46	10	116	55	40	29	Duke *	41	22	124	58	..
14	Crown	45	4	117	57	20	30	Black-eyed Marrowfat	39	38	118	52	..
15	Arthur *	44	58	117	77	..	31	Chancellor	39	38	113	51	20
16	Paragon *	44	54	120	73	20							

The average crop of the thirty-one varieties of pease tested on the Experimental Farm at Brandon in 1904 was 65 bus. 27 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Paragon *	49	8	118	61	20	17	Arthur *	43	54	118	61	40
2	Daniel O'Rourke	48	35	109	67	..	18	Black-eyed Marrowfat	43	38	117	63	40
3	Crown	47	46	113	62	40	19	Archer *	42	54	118	61	40
4	Prussian Blue	47	42	115	67	..	20	Wisconsin Blue	42	54	118	54	..
5	Pride	47	30	114	63	20	21	Macoun *	42	42	120	31	40
6	Picton *	47	18	115	68	20	22	Pearl *	41	34	117	58	20
7	Prince *	47	18	114	66	..	23	Mackay *	40	26	119	45	40
8	Early Britain	46	50	113	55	40	24	Golden Vine	40	26	113	58	..
9	Carleton *	46	14	118	59	..	25	Nelson *	40	10	117	48	40
10	English Grey	45	22	113	58	20	26	Mummy	40	10	112	50	40
11	White Wonder	45	14	109	62	20	27	Duke *	39	50	118	54	..
12	Gregory *	45	6	118	40	..	28	Kent *	39	18	119	45	40
13	German White	45	6	113	61	40	29	White Marrowfat	38	2	117	55	..
14	Agnes *	45	2	114	65	20	30	Prince Albert	36	38	116	37	40
15	Chancellor	44	46	112	59	20	31	Victoria *	34	18	119	35	20
16	King *	43	58	117	51	20							

The average crop of the thirty-one varieties of pease tested on the Experimental Farm at Indian Head in 1904 was 55 bus. 48 lbs per acre.

PEASE—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B. C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1904.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	White Marrowfat	42	..	125	37	20	17	Daniel O'Rourke	35	54	117	38	40
2	Early Britain	41	24	119	35	40	18	Black-eyed Marrowfat	35	44	122	32	..
3	White Wonder	39	18	123	30	30	19	Pearl *	35	43	125	29	20
4	Pride	39	2	122	33	..	20	Prince Albert	35	36	123	30	20
5	Prince *	39	..	122	35	20	21	King *	35	34	123	32	10
6	German White	38	38	120	38	30	22	Gregory *	35	30	122	34	20
7	Mackay *	38	14	123	32	50	23	Picton *	35	10	124	28	..
8	Duke *	38	14	126	37	30	24	Wisconsin Blue	35	10	124	34	40
9	Agnes *	37	56	123	27	10	25	Carleton *	35	6	123	32	20
10	Arthur *	37	50	121	28	40	26	Prussian Blue	35	4	122	32	40
11	English Grey	37	24	121	35	30	27	Victoria *	35	..	125	36	40
12	Macoun *	36	48	124	38	50	28	Golden Vine	34	42	123	28	10
13	Nelson *	36	44	120	30	40	29	Paragon *	34	40	125	32	30
14	Kent *	36	28	125	40	..	30	Chancellor	34	30	125	26	40
15	Crown	36	22	122	33	20	31	Archer *	32	22	126	27	20
16	Mummy	36	12	124	34	..							

The average crop of the thirty-one varieties of pease tested on the Experimental Farm at Agassiz in 1904 was 33 bushels 3 lbs. per acre.

INDIAN CORN.

The number of varieties of Indian corn tested in 1904 was nineteen. These were sown in rows about three feet apart, and the plants thinned out to six or eight inches apart in the rows. The dates of sowing were as follows:—At Ottawa, Ont., June 7; Nappan, N.S., June 1; Brandon, Man., May 26; Indian Head, N.W.T., May 21; and at Agassiz, B.C., May 20.

The crop in each case was cut green and put into the silo for the winter feeding of stock. The dates of cutting were:—At Ottawa, Ont., Sept. 16; Nappan, N.S., Sept. 28; Brandon, Man., Sept. 23; Indian Head, N.W.T., Sept. 13; and at Agassiz, B.C., Oct. 8 to 11.

The yield per acre has been calculated in each case from the weight obtained from two rows each 66 feet long.

In Canada the ton is 2000 lbs.

INDIAN CORN—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average yield for 1904.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Superior Fodder.....	19	1020	18	1903	10	Early Butler..... ...	17	1674	14	1342
2	Salzer's All Gold.....	19	515	20	20	11	Angel of Midnight....	17	887	16	1488
3	Giant Prolific Ensilage	19	98	18	1048	12	North Dakota White..	16	1906	14	1084
4	Early Mastodon	18	1617	13	972	13	White Cap Yellow Dent	16	1861	17	782
5	Red Cob Ensilage.....	18	1536	17	1970	14	Cloud's Early Yellow..	16	1315	14	146
6	Pride of the North....	18	736	15	1988	15	Longfellow.....	16	1250	14	1174
7	Mammoth Cuban.....	18	501	15	668	16	Selected Leaming.....	16	316	9	1633
8	Champion White Pearl	18	485	15	1104	17	Evergreen Sugar.....	15	570	11	1100
9	Compton's Early.....	17	1785	17	54						

Varieties tested for less than five years.	Average yield for less than five years.		Average yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average yield for 1904.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (3 years).....	18	1808	16	1990	King Philip (3 years)...	16	1999	16	1132

The average crop of the nineteen varieties of Indian corn tested on all the Experimental Farms in 1904 was 15 tons 1585 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Giant Prolific Ensilage	23	299	24	1500	10	Champion White Pearl	19	1809	16	1330
2	Superior Fodder.....	22	1832	25	600	11	Compton's Early.....	19	1039	16	835
3	Salzer's All Gold.....	22	726	23	420	12	Cloud's Early Yellow.	19	588	17	980
4	Early Mastodon.... .	22	363	18	520	13	Selected Leaming.....	19	412	12	750
5	Early Butler.....	21	1164	19	940	14	North Dakota White..	18	762	17	1530
6	Red Cob Ensilage....	21	944	21	1780	15	Longfellow	17	1530	15	1240
7	Mammoth Cuban.....	20	1558	18	1730	16	Evergreen Sugar ...	17	1200	15	1240
8	White Cap Yellow Dent	20	1164	21	1780	17	Angel of Midnight....	16	1850	14	1590
9	Pride of the North....	20	542	18	850						

Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (3 years).....	24	657	26	140	King Philip (3 years).....	18	1913	17	320

The average crop of the nineteen varieties of Indian corn tested on the Central Experimental Farm in 1904 was 19 tons 109 lbs. per acre.

INDIAN CORN—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Superior Fodder.....	19	764	17	100	10	Mammoth Cuban.....	17	1926	11	1430
2	Giant Prolific Ensilage.	19	698	15	800	11	Selected Leaming.....	17	1024	10	350
3	Red Cob Ensilage.....	19	302	17	870	12	Cloud's Early Yellow .	17	860	12	1850
4	Early Mastodon..... .	18	1400	13	950	13	White Cap Yellow Dent	17	606	14	930
5	Salzer's All Gold.....	18	1370	20	700	14	Angel of Midnight....	17	220	14	1480
6	Pride of the North....	18	610	17	320	15	Evergreen Sugar.... .	16	1880	15	800
7	Early Butler.....	18	586	14	490	16	Compton's Early.....	16	1594	13	1500
8	Longfellow	18	232	15	1668	17	North Dakota White..	15	1900	11	1650
9	Champion White Pearl	18	14	12	750						

Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (3 years)..... ..	19	756	15	1350	King Philip.....	16	1257	15	1900

The average crop of the nineteen varieties of Indian corn tested on the Experimental Farm at Nappan in 1904 was 14 tons 1468 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Champion White Pearl	19	1186	21	768	10	Longfellow.....	17	795	18	432
2	Superior Fodder ...	19	940	22	1408	11	Angel of Midnight....	17	716	17	1112
3	North Dakota White..	19	482	17	1640	12	Early Butler....	17	285	16	1000
4	Giant Prolific Ensilage.	18	678	25	160	13	Pride of the North....	16	1783	17	1640
5	Salzer's All Gold.....	18	362	21	240	14	White Cap Yellow Dent	16	1246	24	840
6	Early Mastodon.....	18	274	16	1000	15	Cloud's Early Yellow..	15	1830	18	960
7	Compton's Early.....	18	98	16	1792	16	Selected Leaming.....	15	1346	13	664
8	Red Cob Ensilage.....	17	1534	23	200	17	Evergreen Sugar. ...	14	670	11	440
9	Mammoth Cuban.....	17	1297	19	1600						

Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (3 years).. .. .	20	209	15	360	King Philip (3 years)...	18	784	20	920

The average crop of the nineteen varieties of Indian corn tested on the Experimental Farm at Brandon in 1904 was 18 tons 1641 lbs. per acre.

INDIAN CORN—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Angel of Midnight....	18	1374	22	270	10	Early Butler.	14	650	11	880
2	Salzer's All Gold.....	16	1396	18	1400	11	Superior Fodder	14	242	11	1320
3	Compton's Early.....	16	41	18	300	12	Mammoth Cuban.....	13	1880	10	20
4	North Dakota White..	15	750	18	300	13	White Cap Yellow Dent	13	1773	15	800
5	Giant Prolific Ensilage.	15	624	13	1280	14	Evergreen Sugar	13	941	10	350
6	Longfellow..... . ..	15	241	12	1410	15	Red Cob Ensilage.....	13	792	13	1500
7	Pride of the North....	15	223	14	1700	16	Cloud's Early Yellow..	13	415	9	700
8	Champion White Pearl	14	1641	15	1130	17	Selected Leaming.. ...	12	1362	3	600
9	Early Mastodon.....	14	1238	9	700						

Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
King Philip (3 years)...	14	1407	19	500	Eureka (3 years).....	13	1441	13	1500

The average crop of the nineteen varieties of Indian corn tested on the Experimental Farm at Indian Head in 1904 was 13 tons 1508 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Red Cob Ensilage.....	22	110	13	1500	10	Early Butler.....	17	1684	13	400
2	Superior Fodder.....	21	1320	18	88	11	Cloud's Early Yellow.	17	880	12	240
3	Pride of the North....	21	524	11	1430	12	Angel of Midnight....	17	276	14	490
4	Mammoth Cuban.....	20	1842	16	560	13	White Cap Yellow Dent	16	516	10	1560
5	Early Mastodon	20	810	9	1690	14	North Dakota White..	15	1636	7	300
6	Salzer's All Gold.....	20	722	16	1440	15	Selected Leaming.....	15	1438	9	1800
7	Giant Prolific Ensilage.	19	192	13	1500	16	Longfellow.....	14	1458	10	1120
8	Compton's Early.....	19	152	19	1840	17	Evergreen Sugar.....	14	160	5	670
9	Champion White Pearl	18	1774	11	1540						

Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield for 1904.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (3 years).....	16	1953	14	600	King Philip (3 years)	16	633	10	20

The average crop of the nineteen varieties of Indian corn tested on the Experimental Farm at Agassiz in 1904 was 12 tons 1199 lbs. per acre.

TURNIPS.

Twenty varieties were tested in 1904, sown in drills, or on the flat, 2½ feet apart. As in previous years, two sowings were made at each farm, the second sowing being about two weeks later than the first. The dates of sowing were as follows:—At Ottawa, Ont., May 17 and 31; Nappan, N.S., May 30 and June 13; Brandon, Man., May 10 and 23; Indian Head, N.W.T., May 15 and 27; and at Agassiz, B.C., May 13 and 27.

The dates of pulling were as follows:—At Ottawa, Oct. 14; Nappan, Oct. 24; Brandon, Oct. 6; Indian Head, Oct. 18; and at Agassiz, Oct. 24.

The varieties are arranged in the following lists in the order of their average yield from the first sowing, for five years.

In Canada the ton is 2000 lbs.

AVERAGE YIELD AT ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years 1st Sowing		Average yield for five years 2nd Sowing.		Average yield for 1904 1st Sowing.		Average yield for 1904 2nd Sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede	32	106	27	51	33	147	27	867
2	Hartley's Bronze	31	600	25	971	29	1910	24	1778
3	Mammoth Clyde	30	1843	25	945	29	782	24	996
4	Carter's Elephant	30	1764	22	1936	32	866	26	693
5	Hall's Westbury	30	1643	25	196	29	1250	25	40
6	Magnum Bonum	30	1297	25	1023	33	1230	27	1784
7	Imperial Swede	30	793	26	83	30	1691	25	1317
8	Drummond Purple Top	30	624	23	1082	31	1150	25	188
9	Halewood's Bronze Top	30	447	23	1974	32	1990	25	33
10	Elephant's Master	30	307	23	1232	31	200	26	223
11	Kangaroo	29	1750	23	1492	31	422	24	1645
12	Skirvings	29	1629	25	37	30	616	27	1294
13	Jumbo	29	1246	23	921	32	1715	24	1698
14	Bangholm Selected	29	573	24	1733	29	1688	26	339
15	East Lothian	29	2	23	1960	29	1132	25	1553
16	Selected Purple Top	28	1940	24	971	28	1924	24	1181
17	Sutton's Champion	28	489	25	1167	29	1016	27	1008

Varieties tested for less than five years.	Average yield for less than five years 1st Sowing.		Average yield for less than five years 2nd Sowing		Average yield for 1904. 1st Sowing.		Average yield for 1904. 2nd Sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Emperor Swede (4 years)	32	99	27	346	30	582	26	1561
Good Luck (3 years)	33	1817	27	138	34	357	26	1439
New Century (3 years)	30	1699	24	1334	27	415	24	977

TURNIPS—*Continued.*

The average yield of the seventeen varieties of turnips on all the farms for five years was 30 tons 297 lbs. per acre from the first sowing and 24 tons 1399 lbs. per acre from the second sowing, an average gain of 5 tons 898 lbs per acre from early sowing.

The average yield of the twenty varieties on all the farms in 1904 was 30 tons 1854 lbs. per acre from the first sowing and 25 tons 1731 lbs. per acre from the second sowing, an average gain of 5 tons 123 lbs. per acre from early sowing.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years. 1st Sowing.		Average yield for five years. 2nd Sowing.		Yield for 1904. 1st Sowing.		Yield for 1904. 2nd Sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Magnum Bonum	37	1281	26	371	42	150	17	1310
2	Drummond Purple Top	37	1124	25	1310	35	372	18	1125
3	Kangaroo	37	1042	24	906	40	850	17	980
4	Jumbo	37	431	22	1655	36	1342	18	1207
5	Carter's Elephant	36	1375	22	1408	34	227	20	260
6	Hall's Westbury	36	187	24	31	40	272	20	1827
7	Imperial Swede	35	1577	25	374	39	45	19	32
8	Halewood's Bronze Top	35	1527	23	233	37	1817	19	1765
9	Mammoth Clyde	35	1296	24	1269	36	1672	16	1990
10	Elephant's Master	35	1115	22	1903	33	1155	18	135
11	East Lothian	34	541	24	972	31	205	15	360
12	Skirvings	33	1386	23	398	32	1010	18	630
13	Perfection Swede	33	1287	25	341	35	785	17	1887
14	Selected Purple Top	33	676	26	1344	31	1607	18	217
15	Bangholm Selected	32	1439	25	374	24	1830	18	1207
16	Sutton's Champion	32	1274	26	1625	39	1860	24	15
17	Hartley's Bronze	31	1475	24	708	37	1652	20	1910

Varieties tested for less than five years.	Average yield for less than five years. 1st Sowing.		Average yield for less than five years 2nd Sowing.		Yield for 1904. 1st Sowing.		Yield for 1904. 2nd Sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Emperor Swede (4 yrs)	39	540	27	161	36	930	18	1290
Good Luck (3 yrs)	43	75	25	1617	36	435	19	1022
New Century (3 yrs)	41	500	21	460	30	835	17	1970

The average yield of the seventeen varieties of turnips on the Central Experimental Farm for five years was 35 tons 296 lbs. per acre from the first sowing and 24 tons 1160 lbs. per acre from the second sowing. An average gain of 10 tons 1136 lbs. per acre from early sowing.

The average yield of the twenty varieties in 1904 was 35 tons 1255 lbs. per acre from the first sowing and 18 tons 1657 lbs. per acre from the second sowing. An average gain of 16 tons 1598 lbs. per acre from early sowing.

TURNIPS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years 1st sowing.		Average yield for five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede	42	212	34	1234	40	335	34	1300
2	Carter's Elephant	41	1424	29	496	38	1220	32	350
3	Kangaroo	40	1675	30	1780	37	745	33	1980
4	Imperial Swede	40	1048	31	73	34	1300	31	700
5	Hartley's Bronze	40	203	30	687	37	1652	34	475
6	Halewood's Bronze Top	39	1200	31	1558	35	455	33	....
7	Elephant's Master	39	1002	31	686	31	1855	33	495
8	Mammoth Clyde	39	903	31	971	35	1775	33	825
9	Magnum Bonum	39	771	32	957	36	1425	34	145
10	Selected Purple Top	38	1616	31	1117	37	1735	30	1875
11	Drummond Purple Top	38	1616	31	271	37	250	31	1855
12	Hall's Westbury	38	1319	32	812	35	950	33	1650
13	Bangholm Selected	38	857	29	1398	32	1175	28	255
14	Jumbo	37	1801	31	1796	39	375	35	785
15	Skirvings	37	1702	29	245	33	1980	28	925
16	Sutton's Champion	36	1644	33	66	35	785	33	1155
17	East Lothian	35	1643	29	47	30	1545	29	575

Varieties tested for less than five years.	Average yield for less than five years 1st sowing.		Average yield for less than five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Emperor Swede (4 yrs)	38	1509	33	1031	37	1900	35	950
Good Luck (3 yrs)	43	130	36	1700	38	1880	35	125
New Century (3 yrs)	38	285	33	242	31	205	31	1525

The average yield of the seventeen varieties of turnips on the Experimental Farm at Nappan for five years was 39 tons 390 lbs. per acre from the first sowing and 31 tons 482 lbs. per acre from the second sowing. An average gain of 7 tons 1908 lbs. per acre from early sowing.

The average yield of the twenty varieties in 1904 was 35 tons 1877 lbs. per acre from the first sowing and 32 tons 1397 lbs. per acre from the second sowing, an average gain of 3 tons 500 lbs. per acre from early sowing.

TURNIPS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years 1st sowing.		Average yield for five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Magnum Bonum	26	1434	17	901	34	640	25	1480
2	Hartley's Bronze	26	150	18	498	29	80	21	240
3	Skirvings	24	1474	18	643	26	800	22	880
4	Hall's Westbury	24	1368	18	1066	31	304	23	200
5	Kangaroo	24	682	15	1416	29	80	19	1600
6	Sutton's Champion	23	1467	16	50	26	1592	21	768
7	Perfection Swede	23	1256	18	696	29	1136	21	1560
8	Jumbo	23	253	17	424	37	1240	25	1480
9	Carter's Elephant	22	1830	13	1826	28	760	21	768
10	Bangholm Selected	22	1725	17	690	30	720	22	880
11	East Lothian	22	1566	15	1680	29	1400	21	768
12	Imperial Swede	22	1355	18	590	28	760	23	200
13	Mammoth Clyde	22	1302	17	1376	26	1328	23	1520
14	Elephant's Master	22	1197	14	459	26	800	19	1600
15	Drummond Purple Top	22	1091	14	1726	28	760	21	1560
16	Halewood's Bronze Top	21	1243	16	314	26	1328	19	280
17	Selected Purple Top	21	874	16	155	28	760	22	616

Varieties tested for less than five years.	Average yield for less than five years 1st sowing.		Average yield for less than five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Emperor Swede (4 yrs)	23	860	16	76	27	1176	19	1600
Good Luck (3 yrs)	33	....	20	392	43	1120	23	1520
New Century (3 yrs)	27	736	18	1400	28	1552	23	1520

The average yield of the seventeen varieties of turnips on the Experimental Farm at Brandon for five years was 23 tons 957 lbs. per acre from the first sowing and 16 tons 1442 lbs. per acre from the second sowing, an average gain of 6 tons 1515 lbs. per acre from early sowing.

The average yield of the twenty varieties in 1904 was 29 tons 1717 lbs. per acre from the first sowing and 22 tons 352 lbs. per acre from the second sowing, an average gain of 7 tons 1365 lbs. per acre from early sowing.

TURNIPS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede	24	1598	24	1128	25	1338	31	228
2	Hartley's Bronze	23	..	22	809	23	..	26	1036
3	Hall's Westbury	22	1495	20	594	25	1904	25	1621
4	Halewood's Bronze Top	22	1212	17	1826	25	1480	20	448
5	Selected Purple Top	21	1863	19	1391	21	287	28	6
6	Skirvings	21	1567	22	1453	28	854	30	814
7	Drummond Purple Top	21	954	17	351	29	268	29	1541
8	Mammoth Clyde	21	18	18	940	23	1944	25	1763
9	Sutton's Champion	20	1033	21	801	22	1964	26	1743
10	Imperial Swede	20	196	23	1592	26	1036	29	834
11	Bangholm Selected	19	1789	19	1446	23	813	26	753
12	Carter's Elephant	19	891	16	1524	20	1438	26	1884
13	Magnum Bonum	19	511	20	1818	26	187	30	1946
14	East Lothian	19	464	19	73	21	570	22	1540
15	Jumbo	19	396	16	1732	26	611	24	227
16	Elephant's Master	18	952	18	375	24	1641	23	247
17	Kangaroo	17	430	18	1806	22	1964	27	1177

Varieties tested for less than five years.	Average yield for less than five years. 1st sowing.		Average yield for less than five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Emperor Swede (4 yrs)	22	762	22	914	26	1036	28	430
New Century (3 yrs)	19	1149	20	1603	26	1318	30	248
Good Luck (3 yrs)	19	897	22	427	26	46	30	1521

The average yield of the seventeen varieties of turnips on the Experimental Farm at Indian Head for five years was 20 tons 1492 lbs. per acre from the first sowing and 19 tons 1862 lbs. per acre from the second sowing, an average gain of 1630 lbs. per acre from early sowing.

The average yield of the twenty varieties in 1904 was 24 tons 1735 lbs. per acre from the first sowing and 27 tons 500 lbs. per acre from the second sowing, an average loss of 2 tons 765 lbs per acre from early sowing.

TURNIPS—*Concluded.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years 1st sowing.		Average yield for five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede	36	177	32	856	34	1140	31	1360
2	Mammoth Clyde	35	1698	25	600	23	1190	22	880
3	Elephant's Master	34	1267	31	737	38	1550	36	640
4	Carter's Elephant	33	1298	32	427	40	685	31	205
5	East Lothian	32	1798	31	1030	34	1940	40	520
6	Imperial Swede	32	1791	31	1784	25	1315	25	820
7	Hartley's Bronze	32	1714	32	154	22	220	21	1230
8	Bangholm Selected	32	1054	32	757	37	1900	31	1360
9	Hall's Westbury	31	1844	30	478	25	820	21	900
10	Halewood's Bronze Top	31	1055	30	1941	39	870	32	1670
11	Drummond Purple Top	31	337	28	1255	28	100	23	860
12	Skirvings	31	16	31	1448	30	390	38	1220
13	Jumbo	30	1347	28	998	24	1005	20	790
14	Magnum Bonum	30	489	30	1050	28	1750	31	40
15	Kangaroo	29	920	28	1552	26	470	25	490
16	Selected Purple Top	29	762	28	848	25	1480	23	1190
17	Sutton's Champion	27	1031	30	1292	22	880	31	1360

Varieties tested for less than five years.	Average yield for less than five years 1st sowing.		Average yield for less than five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Emperor Swede (4 yrs)	36	822	36	1546	22	1870	31	1535
Good Luck (3 yrs)	30	1985	30	555	26	305	24	1005
New Century (3 yrs)	27	1825	29	963	19	115	18	1620

The average yield of the seventeen varieties of turnips on the Experimental Farm at Agassiz for five years was 32 tons 35 lbs. per acre from the first sowing and 30 tons 895 lbs. per acre from the second sowing, an average gain of 1 ton 1140 lbs. per acre from early sowing.

The average yield of the twenty varieties in 1904 was 28 tons 1699 lbs. per acre from the first sowing and 28 tons 384 lbs. per acre from the second sowing, an average gain of 1315 lbs. per acre from early sowing.

MANGELS.

Sixteen varieties of mangels have been under test during 1903. All were sown in drills or on the flat in rows 2½ feet apart. Two sowings were made at each farm, the second sowing being about two weeks later than the first. The dates of sowing were as follows:—At Ottawa, Ont., May 17 and 31; Nappan, N.S., May 30 and June 13; Brandon, Man., May 7 and 21; Indian Head, N.W.T., May 19 and 27; and at Agassiz, B.C., April 25 and May 9.

MANGELS—*Continued.*

The dates of pulling were as follows :—At Ottawa, Oct. 14; Nappan, Oct. 12; Brandon, Sept. 24; Indian Head, Oct. 3; and at Agassiz, Oct. 22.

The varieties are arranged in the following lists in the order of their average yield, from the first sowing, for five years.

In Canada the ton is 2000 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Average yield for 1904. 1st sowing.		Average yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Mammoth Long Red	31	651	25	319	26	14	19	938
2	Mammoth Yellow Intermediate	31	294	25	658	29	341	23	751
3	Giant Yellow Intermediate	30	1471	23	1493	25	1831	21	38
4	Lion Yellow Intermediate	30	456	25	904	26	1693	22	1169
5	Half Long Sugar white	29	1491	24	1641	27	1474	23	224
6	Yellow Intermediate	29	987	24	215	30	599	22	1008
7	Giant Yellow Globe	28	778	24	322	24	1840	22	1887
8	Prize Mammoth Long Red	28	614	23	1460	24	72	20	1552
9	Gate Post	28	351	23	1870	22	984	20	811
10	Selected Mammoth Long Red	27	1974	24	1348	22	1028	18	277
11	Half Long Sugar Rosy	27	1093	22	119	21	1296	18	104

Varieties tested for less than five years.	Average yield for less than five years. 1st sowing.		Average yield for less than five years. 2nd sowing.		Average yield for 1904. 1st sowing.		Average yield for 1904. 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Prize Winner Yellow Globe † (4 yrs)	29	1685	24	1532	28	469	21	1783
Triumph Yellow Globe (4 yrs)	28	1282	23	1257	25	1676	20	1006
Leviathan Long Red (4 yrs)	26	819	23	458	23	1495	20	533
Selected Yellow Globe † (3 yrs)	29	1734	24	98	22	987	21	1457
Giant Sugar Mangel † (3 yrs)	27	1917	22	1772	25	232	20	1476

The average yield of the eleven varieties of mangels on all the farms for five years was 29 tons 742 lbs. per acre from the first sowing and 24 tons 577 lbs. per acre from the second sowing. An average gain of 5 tons 165 lbs. per acre from early sowing.

The average yield of the sixteen varieties on all the farms in 1904 was 25 tons 877 lbs. per acre from the first sowing and 21 ton 188 lbs. per acre from the second sowing. An average gain of 4 tons 689 lbs. per acre from early sowing.

MANGELS—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years 1st sowing.		Average yield for five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Mammoth Long Red	43	97	28	521	34	1630	17	897
2	Mammoth Yellow Intermediate	41	1638	27	1407	34	722	17	1640
3	Yellow Intermediate	39	61	27	1908	32	1257	16	1907
4	Half Long Sugar White	38	1170	25	391	36	1507	18	1785
5	Lion Yellow Intermediate	38	522	29	377	30	637	17	1310
6	Prize Mammoth Long Red	38	345	25	1645	37	167	17	815
7	Giant Yellow Intermediate	36	1986	22	22	32	1175	16	1495
8	Gate Post	36	1986	27	1308	24	1005	16	670
9	Giant Yellow Globe	35	653	23	662	27	285	13	1390
10	Half Long Sugar Rosy	35	533	21	1774	26	1542	14	957
11	Selected Mammoth Long Red	33	1782	25	1381	29	80	16	340

Varieties tested for less than five years.	Average yield for less than five years 1st sowing.		Average yield for less than five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Triumph Yellow Globe (4 yrs)	39	292	24	242	31	40	16	422
Prize Winner Yellow Globe (4 yrs)	38	209	25	510	30	142	15	1762
Leviathan Long Red (4 yrs)	33	1175	23	1334	29	1482	14	1452
Selected Yellow Globe (3 yrs)	34	860	19	1187	24	1665	14	1287
Giant Sugar Mangel (3 yrs)	33	1485	20	1855	28	1090	15	1185

The average yield of the eleven varieties of mangels on the Central Experimental Farm for five years was 37 tons 1888 lbs. per acre from the 1st sowing and 25 tons 1763 lbs. per acre from the second sowing, an average gain of 12 tons 125 lbs. per acre from early sowing.

The average yield of the sixteen varieties in 1904 was 30 tons 1277 lbs. per acre from the first sowing and 16 tons 582 lbs. per acre from the second sowing, an average gain of 14 tons 695 lbs. per acre from early sowing.

MANGELS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years 1st sowing.		Average yield for five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Lion Yellow Intermediate	42	348	35	1676	33	660	31	535
2	Mammoth Yellow Intermediate	41	1490	34	1729	36	435	30	1380
3	Giant Yellow Intermediate	40	256	32	1142	33	495	27	285
4	Yellow Intermediate	39	111	31	665	40	1015	31	1525
5	Giant Yellow Globe	36	1656	32	119	22	1870	22	550
6	Gate Post	35	851	29	707	20	425	25	1480
7	Prize Mammoth Long Red	35	59	29	1499	21	1395	24	1005
8	Mammoth Long Red	34	1234	29	1532	19	1600	18	630
9	Half Long Sugar White	33	1947	29	686	26	305	25	490
10	Half Long Sugar Rosy	33	1782	28	1123	25	1810	24	510
11	Selected Mammoth Long Red	33	1749	30	456	20	1085	20	590

Varieties tested for less than five years.	Average yield for less than five years 1st sowing.		Average yield for less than five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Prize Winner Yellow Globe † (4 yrs)	37	250	29	204	..	....	15	855
Leviathan Long Red (4 yrs)	32	389	29	781	25	490	21	900
Triumph Yellow Globe (4 yrs)	30	1999	29	985	19	280	19	610
Selected Yellow Globe (3 yrs)	38	560	31	651	22	1540	21	735
Giant Sugar Mangel (3 yrs)	33	1100	27	1172	28	1090	24	530

The average yield of the eleven varieties of mangels on the Experimental Farm at Nappan for five years was 36 tons 1953 lbs. per acre from the first sowing, and 31 tons 485 lbs. per acre from the second sowing,an average gain of 5 tons 1468 lbs. per acre from early sowing.

The average yield of the varieties grown in 1904 was 26 tons 833 lbs. per acre from the first sowing and 23 tons 1913 lbs. per acre from the second sowing, an average gain of 2 tons 920 lbs. per acre from early sowing.

MANGELS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Half Long Sugar White	27	1546	25	213	35	1544	31	40
2	Mammoth Long Red	27	1176	22	88	31	1096	27	120
3	Selected Mammoth Long Red	25	1323	23	415	31	304	29	1928
4	Mammoth Yellow Intermediate	24	418	20	1382	39	1992	31	568
5	Gate Post	23	728	22	888	37	712	29	872
6	Yellow Intermediate	23	358	20	245	31	1624	38	32
7	Prize Mammoth Long Red	23	253	21	82	28	496	30	192
8	Giant Yellow Intermediate	22	1857	18	1963	31	40	31	304
9	Half Long Sugar Rosy	22	1381	19	650	26	800	28	760
10	Giant Yellow Globe	21	1190	23	992	25	160	35	1280
11	Lion Yellow Intermediate	21	768	18	1277	27	648	24	1104

Varieties tested for less than five years.	Average yield for less than five years. 1st sowing.		Average yield for less than five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Triumph Yellow Globe (4 yrs)	26	1196	22	682	31	568	28	760
Leviathan Long Red (4 yrs)	24	76	20	1448	31	40	28	496
Prize Winner Yellow Globe (4 yrs)	23	266	25	333	31	1360	30	1512
Selected Yellow Globe (3 yrs)	22	1848	25	1568	24	1896	36	600
Giant Sugar Mangel (3 yrs)	22	264	20	1712	29	80	27	648

The average yield of the eleven varieties of mangels on the Experimental Farm at Brandon for five years was 23 tons 1909 lbs. per acre from the first sowing and 21 tons 745 lbs. per acre from the second sowing. An average gain of 2 tons 1164 lbs. per acre from early sowing.

The average yield of the sixteen varieties in 1904 was 30 tons 1710 lbs. per acre from the first sowing and 30 tons 951 lbs. per acre from the second sowing. An average gain of 759 lbs. from early sowing.

MANGELS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Giant Yellow Intermediate	22	1963	18	1627	19	1176	18	347
2	Lion Yellow Intermediate	21	1651	19	1136	..	....	25	914
3	Prize Mammoth Long Red	21	1056	19	1443	18	206	17	1498
4	Gate Post	21	802	17	1403	16	528	23	247
5	Giant Yellow Globe	21	394	21	131	18	1903	26	1743
6	Mammoth Yellow Intermediate	21	377	18	702	17	650	23	1237
7	Selected Mammoth Long Red	20	1298	20	1877	19	327	16	953
8	Half Long Sugar White	20	1063	19	1043	21	....	26	1743
9	Half Long Sugar Rosy	19	1722	15	1856	18	1054	14	1134
10	Mammoth Long Red	19	1115	19	1448	16	1094	17	1781
11	Yellow Intermediate	19	1041	19	895	19	186	16	1094

Varieties tested for less than five years.	Average yield for less than five years. 1st sowing.		Average yield for less than five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Prize Winner Yellow Globe (4 yrs)	23	608	21	243	23	1237	27	1581
Triumph Yellow Globe (4 yrs)	22	520	21	1670	23	388	27	1581
Leviathan Long Red (4 yrs)	20	209	19	1730	18	1478	23	1944
Selected Yellow Globe † (3 yrs)	21	1140	17	1626	..	....	23	671
Giant Sugar Mangel † (3 yrs)	18	660	18	1242	..	...	22	1823

The average yield of the eleven varieties of mangels on the Experimental Farm at Indian Head for five years was 20 tons 1862 lbs. per acre from the first sowing and 19 tons 324 lbs. per acre from the second sowing, an average gain of 1 ton 1538 lbs. per acre from early sowing.

The average yield of the varieties grown in 1904 was 19 tons 479 lbs. per acre from the first sowing and 22 tons 143 lbs. per acre from the second sowing, an average loss of 2 tons 1664 lbs. per acre from early sowing.

MANGELS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B. C.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
		Tons	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Mammoth Long Red	31	1631	26	6	27	648	16	1264
2	Giant Yellow Intermediate	30	1293	26	712	13	268	11	1760
3	Half Long Sugar White	27	1728	24	1874	19	16	13	1060
4	Lion Yellow Intermediate	27	989	24	53	16	826	13	1984
5	Giant Yellow Globe	26	1997	20	1705	30	984	16	473
6	Mammoth Yellow Intermediate	26	1546	25	68	17	1904	13	928
7	Yellow Intermediate	26	1365	21	1364	27	912	9	480
8	Half Long Sugar Rosy	26	49	24	1192	10	1272	8	1160
9	Selected Mammoth Long Red	25	1718	23	609	12	1344	7	1576
10	Gate Post	23	1384	22	1043	14	248	7	784
11	Prize Mammoth Long Red	23	1359	22	632	15	96	14	248

Varieties tested for less than five years.	Average yield for less than five years. 1st sowing.		Average yield for less than five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Prize Winner Yellow Globe (4 years)	27	1094	23	343	18	1356	19	1204
Triumph Yellow Globe (4 years)	25	401	20	702	24	1104	10	1658
Leviathan Long Red (4 years)	22	245	22	995	13	1984	12	1872
Selected Yellow Globe (3 years)	32	262	25	1458	18	696	13	4
Giant Sugar Mangel (3 years)	32	75	26	877	21	240	13	1192

The average yield of the eleven varieties of mangels on the Experimental Farm at Agassiz for five years was 27 tons 96 lbs. per acre from the first sowing and 23 tons 1569 lbs. per acre from the second sowing, an average gain of 3 tons 527 lbs. per acre from early sowing.

The average yield of the sixteen varieties grown in 1904 was 18 tons 1619 lbs. per acre from the first sowing and 12 tons 1353 lbs. per acre from the second sowing, an average gain of 6 tons 266 lbs. per acre from early sowing.

CARROTS.

Ten different sorts of carrots were tested during 1904, all being sown in drills or on the flat in rows two feet a part. Two sowings were made in each case, the second sowing being about two weeks later than the first. The dates of sowing were as follows:—At Ottawa, Ont. May 17 and 31; Nappan, N.S. May 30 and June 13; Brandon, Man., May 7 and 21; Indian Head, N.W.T., May 19 and May 27; and at Agassiz, B.C. April 25 and May 9.

CARROTS—*Continued.*

The dates of pulling were as follows:—At Ottawa, Oct. 14; Nappan, Oct. 25; Brandon, Sept. 27; Indian Head, Oct. 20; and at Agassiz, Oct. 24.

The varieties are arranged in the following lists in the order of their average yield, from the first sowing, for five years.

In Canada the ton is 2,000 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years, (omitting Indian Head for 1904) 1st sowing.		Average yield for five years, (omitting Indian Head for 1904) 2nd sowing.		Average yield for 1904 (omitting Indian Head) 1st sowing		Average yield for 1904, (omitting Indian Head) 2nd sowing	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Giant White Vosges	23	1846	19	814	22	1747	18	80
2	New White Intermediate	23	722	18	1834	23	523	17	1681
3	Ontario Champion	22	1794	18	814	22	1886	16	681
4	Mammoth White Intermediate	22	1692	19	1108	22	222	19	335
5	Improved Short White	22	826	19	338	20	780	18	602
6	White Belgian	20	132	16	1784	20	1209	15	1194
7	Long Yellow Stump Rooted	19	757	16	1265	22	344	19	60
8	Half Long Chantenay	18	875	15	1753	18	1249	16	230
9	Carter's Orange Giant	18	148	15	1339	22	735	18	231
10	Early Gem	16	1836	15	911	17	1764	17	1200

The average yield of the ten varieties of carrots on all the Experimental Farms for five years (omitting Indian Head for 1904) was 20 tons 1663 lbs. per acre from the first sowing and 17 tons 1196 lbs. per acre from the second sowing, an average gain of 3 tons 467 lbs. per acre from early sowing

The average yield of the ten varieties for 1904 (omitting Indian Head) was 21 tons 646 lbs. per acre from the first sowing and 17 tons 1229 lbs. per acre from the second sowing, an average gain of 3 tons 1417 lbs. per acre from early sowing.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	New White Intermediate	32	1521	26	239	24	592	18	1785
2	Mammoth White Intermediate	32	1307	27	1638	23	200	19	1600
3	Giant White Vosges	31	1525	25	292	24	1995	21	570
4	Improved Short White	29	1928	26	1130	21	1560	20	1415
5	Ontario Champion	29	1466	24	147	24	840	16	1165
6	Half Long Chantenay	26	1625	20	392	18	1950	13	1225
7	Long Yellow Stump Rooted	26	870	21	966	19	1930	16	1330
8	Carter's Orange Giant	24	1615	19	676	19	1022	17	1805
9	White Belgian	23	695	20	920	17	815	14	710
10	Early Gem	21	471	19	973	18	300	17	1805

CARROTS—*Continued.*

The average yield of the ten varieties of carrots on the Central Experimental Farm for five years was 27 tons 1902 lbs. per acre from the first sowing and 23 tons 137 lbs. per acre from the second sowing, an average gain of 4 tons 1765 lbs. per acre from early sowing.

The average yield of the ten varieties for 1904 was 21 tons 520 lbs. per acre from the first sowing and 17 tons 1541 lbs. per acre from the second sowing, an average gain of 3 tons 979 lbs. per acre from early sowing.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Giant White Vosges	24	708	18	1257	18	960	16	340
2	Mammoth White Intermediate	24	609	19	355	21	1890	18	1620
3	Ontario Champion	23	827	18	1620	18	630	18	960
4	New White Intermediate	22	1903	19	1006	18	1290	17	1145
5	Improved Short White	21	1593	17	1079	16	1660	14	710
6	Long Yellow Stump Rooted	20	986	17	1603	19	1765	18	1950
7	White Belgian	20	788	16	371	20	260	18	1445
8	Half Long Chantenay	18	1039	17	617	18	465	17	1970
9	Early Gem	17	1607	16	637	17	1475	16	1330
10	Carter's Orange Giant	17	23	16	880	20	1910	19	1105

The average yield of the ten varieties of carrots on the Experimental Farm at Nappan for five years was 21 tons 208 lbs. per acre from the first sowing and 17 tons 1542 lbs. per acre from the second sowing, an average gain of 3 tons 666 lbs. per acre from early sowing.

The average yield of the ten varieties for 1904 was 19 tons 230 lbs. per acre from the first sowing and 17 tons 1457 lbs. per acre from the second sowing, an average gain of 1 ton. 773 lbs. per acre from early sowing.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	New White Intermediate	22	1408	13	994	38	1440	24	840
2	Ontario Champion	22	176	13	1630	35	1720	18	840
3	Improved Short White	18	1576	14	996	33	440	26	1680
4	White Belgian	18	1356	12	902	33	...	18	840
5	Giant White Vosges	18	80	13	202	26	800	15	800
6	Long Yellow Stump Rooted	17	1112	15	1746	36	600	29	520
7	Mammoth White Intermediate	16	318	15	1570	30	280	24	1720
8	Carter's Orange Giant	15	196	13	1610	31	1360	25	1040
9	Half Long Chantenay	14	1766	14	864	28	760	24	1720
10	Early Gem	12	1124	13	1698	22	880	23	1080

CARROTS—*Continued.*

The average yield of the ten varieties of carrots on the Experimental Farm at Brandon for five years was 17 tons 1311 lbs. per acre from the first sowing and 14 tons 221 lbs. per acre from the second sowing on average gain of 3 tons 1090 lbs. per acre from early sowing.

The average yield of the ten varieties for 1904 was 31 tons 1228 lbs. per acre from the first sowing and 23 tons 308 lbs. per acre from the second sowing, an average gain of 8 tons 920 lbs. per acre from early sowing.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for four years. 2nd sowing.		Yield for 1904. 1st sowing.		Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for four years. 2nd sowing.		Yield for 1904. 1st sowing.	
		Tns.	Lbs	Tns.	Lbs	Tns.	Lbs			Tns.	Lbs	Tns.	Lbs	Tns.	Lbs
1	Improved Short White	12	606	11	1992	7	284	7	Long Yellow Stump Rooted	10	1076	9	1369	2	1657
2	New White Intermediate	11	1442	11	101	4	768	8	Early Gem	9	1884	8	585	2	1091
3	Giant White Vosges	11	616	10	1123	4	1051	9	Mammoth White Intermediate	9	1484	9	784	1	1536
4	Ontario Champion	11	471	11	75	1	1536	10	Carter's Orange Giant	8	1478	8	662	2	1091
5	Half Long Chantenay	11	396	9	525	5	1314								
6	White Belgian	10	1878	10	542	6	1294								

The average yield of the ten varieties of carrots on the Experimental Farm at Indian Head was 9 tons 1433 lbs. per acre from the first sowing for five years, and 9 tons 1876 lbs. per acre from the second sowing for four years, an average loss of 443 lbs. per acre from early sowing.

The average yield of the ten varieties for 1904 was 3 tons 1962 lbs. per acre from the first sowing. Owing to unfavourable conditions the second sowing failed in 1904.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Giant White Vosges	32	911	29	1194	21	1232	19	610
2	Mammoth White Intermediate	29	753	25	1194	13	520	13	400
3	Improved Short White	27	1846	25	495	9	1460	11	605
4	White Belgian	25	1799	25	184	11	1760	10	1780
5	Ontario Champion	25	1295	24	598	13	355	11	1760
6	New White Intermediate	24	1666	24	829	11	770	10	955
7	Carter's Orange Giant	23	332	20	865	17	650	9	975
8	Early Gem	21	394	19	662	13	400	12	585
9	Long Yellow Stump Rooted	19	1886	18	641	12	1080	11	440
10	Half Long Chantenay	19	1281	18	368	8	1820	8	5

CARROTS—*Concluded.*

The average yield of the ten varieties of carrots on the Experimental Farm at Agassiz for five years was 25 tons 16 lbs. per acre from the first sowing and 23 tons 103 lbs. per acre from the second sowing, an average gain of 1 ton 1913 lbs. per acre from early sowing.

The average yield of the ten varieties for 1904 was 13 tons 612 lbs. per acre from the first sowing and 11 tons 1611 lbs. per acre from the second sowing, an average gain of 1 ton 1001 lbs. per acre from early sowing.

SUGAR BEETS.

Eight varieties of sugar beets have been tested during 1904, sown in drills or on the flat in rows two feet apart. Two sowings were made at each farm, the second sowing being about two weeks later than the first. The dates of sowing were:—At Ottawa, Ont., May 17 and 31; Nappan, N.S., May 30 and June 13; Brandon, Man., May 7 and 21; and at Indian Head, N.W.T., May 19 and 27.

The dates of pulling were as follows:—At Ottawa, Oct. 14; Nappan, Oct. 12; Brandon, Sept. 24; and at Indian Head, Oct. 6.

The yield per acre in each instance has been calculated from the weight of roots gathered from two rows each 66 feet long.

Though all the varieties included in these tests are commonly classed as sugar beets it should be noted that the only sorts recommended for use in the manufacture of beet sugar are Wanzleben, Vilmorin's Improved, and French Very Rich.

In Canada the ton is 2000 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years (omitting Agassiz for 1904) 1st sowing.		Average yield for five years (omitting Agassiz for 1904) 2nd sowing.		Average yield for 1904 (omitting Agassiz) 1st sowing.		Average yield for 1904 (omitting Agassiz) 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Danish Red Top	24	1813	21	1982	21	111	19	163
2	Danish Improved	24	1288	21	486	21	60	18	1147
3	Red Top Sugar	24	846	21	1766	24	309	22	1145
4	Improved Imperial	23	1052	21	451	20	1104	19	571
5	Wanzleben	21	794	18	492	18	1888	15	1508
6	Vilmorin's Improved	19	1218	17	735	16	1617	13	1481

Varieties tested for less than five years.	Average yield for less than five years (omitting Agassiz for 1904) 1st sowing.		Average yield for less than five years (omitting Agassiz for 1904) 2nd sowing.		Average yield for 1904 (omitting Agassiz) 1st sowing.		Average yield for 1904. (omitting Agassiz) 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Royal Giant (4 yrs)	25	1227	22	1395	24	1231	21	1673
French Very Rich (3 yrs)	18	549	16	35	16	425	12	1192

SUGAR BEETS—*Continued.*

The average yield of the six varieties of sugar beets on all the Experimental Farms for five years (omitting Agassiz in 1904) was 23 tons 168 lbs. per acre from the first sowing and 20 tons 652 lbs. per acre from the second sowing, an average gain of 2 tons 1516 lbs. per acre from early sowing.

The average yield of the eight varieties for 1904 (omitting Agassiz) was 20 tons 843 lbs. per acre from the first sowing and 17 tons 1860 lbs. per acre from the second sowing, an average gain of 2 tons 983 lbs. per acre from early sowing.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years 1st sowing.		Average yield for five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Red Top Sugar	31	947	21	669	32	762	18	465
2	Danish Improved	30	934	20	1514	27	532	15	1680
3	Danish Red Top	30	175	21	1725	26	222	14	380
4	Improved Imperial	29	1878	21	1741	23	1272	15	277
5	Wanzleben	26	1542	18	448	21	982	15	1432
6	Vilmorin's Improved	23	249	14	1667	19	1847	12	585

Varieties tested for less than five years.	Average yield for less than five years 1st sowing.		Average yield for less than five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Royal Giant (4 yrs)	30	1957	23	35	31	40	18	135
French Very Rich (3 yrs)	21	982	15	1405	17	1062	11	110

The average yield of the six varieties of sugar beets on the Central Experimental Farm for five years was 28 tons 1287 lbs. per acre from the first sowing and 19 tons 1627 lbs. per acre from the second sowing, an average gain of 8 tons 1660 lbs. per acre from early sowing.

The average yield of the eight varieties for 1904 was 24 tons 1840 lbs. per acre from the first sowing and 15 tons 133 lbs. per acre from the second sowing, an average gain of 9 tons 1707 lbs. per acre from early sowing.

SUGAR BEETS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years 1st sowing.		Average yield for five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Red Top Sugar	27	1275	25	457	26	140	27	1440
2	Danish Red Top	26	1757	24	510	20	95	20	755
3	Improved Imperial	26	666	22	220	23	355	21	75
4	Danish Improved	24	1949	22	946	20	1910	19	775
5	Wanzleben	24	213	20	821	22	880	18	1455
6	Vilmorin's Improved	22	914	19	841	18	795	16	1330

Varieties tested for less than five years.	Average yield for less than five years 1st sowing.		Average yield for less than five years 2nd sowing.		Yield for 1904 1st sowing.		Yield for 1904 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Royal Giant (4 yrs)	31	782	27	1935	24	1830	20	425
French Very Rich (3 yrs)	19	1160	16	175	14	1205	12	1575

The average yield of the six varieties of sugar beets on the Experimental Farm at Nappan for five years was 25 tons 796 lbs. per acre from the first sowing and 22 tons 632 lbs. per acre from the second sowing, an average gain of 3 tons 164 lbs. per acre from early sowing.

The average yield of the eight varieties in 1904 was 21 tons 651 lbs. per acre from the first sowing and 19 tons 1229 lbs. per acre from the second sowing, an average gain of 1 ton 1422 lbs. per acre from early sowing.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Danish Improved	24	272	19	1851	23	200	20	656
2	Red Top Sugar	23	1216	21	1956	24	48	25	1480
3	Danish Red Top	23	741	22	1052	23	992	23	464
4	Wanzleben	21	1969	17	518	22	880	18	1488
5	Improved Imperial	19	240	21	293	21	504	24	840
6	Vilmorin's Improved	16	1660	15	743	17	1904	16	208

SUGAR BEETS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.—*Con.*

Varieties tested for less than five years.	Average yield for less than five years. 1st sowing.		Average yield for less than five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Royal Giant (4 years)	18	168	19	1996	25	688	25	1744
French Very Rich (3 years)	14	1040	12	1520	21	240	14	1040

The average yield of the six varieties of sugar beets on the Experimental Farm at Brandon for five years was 21 tons 1016 lbs. per acre from the first sowing and 19 tons 1402 lbs. per acre from the second sowing, an average gain of 1 ton 1614 lbs. per acre from early sowing.

The average yield of the eight varieties in 1904 was 22 tons 682 lbs. per acre from the first sowing and 21 tons 240 lbs. per acre from the second sowing, an average gain of 1 ton 442 lbs. per acre from early sowing.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years. 1st sowing.		Average yield for five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
1	Improved Imperial	17	1610	17	732	14	286	16	1094
2	Danish Red Top	17	1070	16	1976	14	1134	18	1054
3	Danish Improved	17	722	18	1964	12	1598	18	1478
4	Red Top Sugar	17	388	17	958	14	286	18	1196
5	Wanzleben	14	483	14	1169	9	810	9	1658
	Vilmorin's Improved	14	93	15	536	10	1921	9	1800

Varieties tested for less than five years.	Average yield for less than five years. 1st sowing.		Average yield for less than five years. 2nd sowing.		Yield for 1904. 1st sowing.		Yield for 1904. 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Royal Giant (4 years)	20	1824	19	426	17	367	23	388
French Very Rich (3 years)	13	106	11	234	11	1194	12	43

The average yield of the six varieties of sugar beets on the Experimental Farm at Indian Head for five years was 16 tons 728 lbs. per acre from the first sowing and 16 tons 1556 lbs. per acre from the second sowing, an average loss of 828 lbs. per acre from early sowing.

The average yield of the eight varieties in 1904 was 13 tons 200 lbs. per acre from the first sowing and 15 tons 1839 lbs. per acre from the second sowing, an average loss of 2 tons 1639 lbs. per acre from early sowing.

SUGAR BEETS—*Concluded.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for four years.	Average yield for four years 1st sowing.		Average yield for four years. 2nd sowing.		Number.	Varieties tested for four years.	Average yield for four years. 1st sowing.		Average yield for four years. 2nd sowing.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Danish Red Top.....	26	1322	24	645	4	Red Top Sugar.....	22	404	23	791
2	Danish Improved.....	26	566	24	157	5	Vilmorin's Improved..	21	1175	21	1890
3	Improved Imperial....	24	867	23	1270	6	Wanzleben.....	19	1765	20	1505

Varieties tested for less than four years.	Average yield for less than four years. 1st sowing.		Average yield for less than four years. 2nd sowing.		Varieties tested for less than four years.	Average yield for less than four years. 1st sowing.		Average yield for less than four years. 2nd sowing.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Royal Giant (3 years)....	26	1405	23	585	French Very Rich (2 years)	22	1457	24	840

The average yield of the six varieties of sugar beets on the Experimental Farm at Agassiz for four years was 23 tons 1016 lbs. per acre from the first sowing and 23 tons 43 lbs. per acre from the second sowing, an average gain of 973 lbs. per acre from early sowing.

The sugar beets failed at Agassiz in 1904.

POTATOES.

Forty-one varieties of potatoes have been under test during 1904. The potatoes were cut into pieces with two or three eyes in each, and these pieces were planted in rows 2½ feet apart, the sets being placed a foot apart in the rows. The dates of planting and digging were as follows :—At Ottawa, Ont., planted May 27, dug Oct. 6 and 7 ; at Nappan, N.S., planted May 31, dug Sept. 1 and 3 ; at Brandon, Man., planted May 4, dug Sept. 26 ; at Indian Head, N.W.T., planted May 20, dug Sept. 29 ; and at Agassiz, B.C., planted May 12, dug Sept. 20 and 21.

In Canada the bushel of potatoes is 60 lbs.

POTATOES—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Average yield for 1904.	
		Bus.	Lbs.	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	Rose No. 9.	421	24	430	19	17	Country Gentleman	387	48	408	32
2	Late Puritan	417	10	462	26	18	Irish Cobbler	386	49	360	10
3	Carman No. 1	416	17	417	11	19	Empire State	381	46	397	2
4	Uncle Sam	414	49	434	43	20	Cambridge Russet	377	55	342	37
5	Burnaby Mammoth	410	57	365	52	21	General Gordon	377	52	406	7
6	Seedling No. 7	403	38	373	7	22	Everett	377	45	364	41
7	Dreer's Standard	401	30	418	14	23	Vick's Extra Early	377	43	385	9
8	Holborn Abundance	398	51	408	28	24	Swiss Snowflake	376	0	355	58
9	American Wonder	398	14	369	49	25	Reeves' Rose	374	40	384	7
10	State of Maine	397	55	402	27	26	Penn Manor	370	58	393	22
11	American Giant	396	55	401	34	27	Maule's Thoroughbred	361	13	337	58
12	Money Maker	395	6	394	9	28	Carman No. 3	360	47	333	49
13	I.X.L.	393	10	387	38	29	Bovee	327	8	287	22
14	Rochester Rose	392	36	398	3	30	Early White Prize	322	19	268	24
15	Delaware	389	17	365	30	31	Early Rose	320	54	320	54
16	Clay Rose	388	41	379	52						

Varieties tested for less than five years.	Average yield for less than five years.		Average yield for 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Average yield for 1904.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Enormous (4 years)	420	1	408	19	Early Andes (4 years)	285	28	258	43
Sabean's Elephant (4 years)	405	8	431	42	Prolific Rose (3 years)	356	25	420	47
Canadian Beauty (4 years)	401	13	364	2	Pearce (2 years)	409	32	409	23
Early St. George (4 years)	358	53	348	5	Early Envoy (2 years)	302	57	302	52
Rawdon Rose (4 years)	347	4	338	30	Pingree (2 years)	275	1	308	26

The average crop of the forty-one varieties of potatoes on all the Experimental Farms for 1904 was 374 bus. 18 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Bus.	Lbs.	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	Late Puritan	485	19	343	12	17	Swiss Snowflake	399	31	334	24
2	Money Maker	482	41	418	..	18	Everett	392	2	387	12
3	Burnaby Mammoth	469	29	462	..	19	American Wonder	387	38	308	..
4	Carman No. 1	459	48	435	36	20	Penn Manor	382	48	374	..
5	Dreer's Standard	458	55	356	24	21	Country Gentleman	378	24	246	24
6	I. X. L.	433	50	365	12	22	Delaware	368	17	277	12
7	Clay Rose	432	58	391	36	23	Empire State	362	7	360	48
8	Irish Cobbler	432	5	246	24	24	General Gordon	352	..	290	24
9	American Giant	418	..	431	12	25	Cambridge Russet	347	36	206	48
10	Uncle Sam	413	36	312	24	26	Early Rose	345	24	343	12
11	Vick's Extra Early	412	17	378	24	27	Carman No. 3	344	58	264	..
12	Rochester Rose	409	12	374	..	28	Maule's Thoroughbred	344	5	233	12
13	Rose No. 9	406	34	382	48	29	Seedling No. 7	333	46	215	36
14	Holborn Abundance	406	7	435	36	30	Early White Prize	301	50	250	48
15	State of Maine	404	48	299	12	31	Bovee	280	43	180	24
16	Reeves' Rose	401	17	404	48						

POTATOES—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Canadian Beauty (4 yrs)..	429	..	365	12	Early Andes (4 yrs).....	201	51	123	12
Sabean's Elephant (4 yrs)	424	36	365	12	Prolific Rose (3 yrs).....	217	48	272	48
Enormous (4 yrs).....	393	48	308	..	Pearce (2 yrs).....	354	12	374	..
Rawdon Rose (4 yrs).....	360	15	334	24	Early Envoy (2 yrs).....	265	6	246	24
Early St. George (4 yrs)..	309	6	215	36	Pingree (2 yrs).....	163	54	290	24

The average crop of the forty-one varieties of potatoes on the Central Experimental Farm in 1904 was 322 bus. 3 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Bus.	Lbs.	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	Vick's Extra Early....	440	26	495	..	17	Penn Manor	348	55	352	..
2	Clay Rose.....	433	50	385	..	18	Bovee.....	344	5	354	12
3	Seedling No. 7.....	426	48	343	12	19	Maule's Thoroughbred.	344	5	367	24
4	Rose No. 9.....	425	29	400	24	20	Uncle Sam.....	344	5	363	..
5	Everett.....	416	17	396	..	21	Money Maker	343	24	331	..
6	Rochester Rose.....	406	34	409	12	22	Empire State.....	341	53	363	..
7	Irish Cobbler.....	401	58	439	..	23	Carman No. 3.	340	7	242	..
8	Holborn Abundance...	395	34	297	..	24	State of Maine.....	334	50	398	12
9	Burnaby Mammoth...	381	29	345	24	25	American Giant.....	331	19	319	..
10	Late Puritan.....	364	19	323	24	26	General Gordon.....	329	36	396	..
11	Carman No. 1.....	360	22	462	..	27	Early White Prize....	328	41	341	..
12	Dreer's Standard.....	358	36	356	24	28	Country Gentleman...	317	41	418	..
13	Delaware.....	356	24	413	36	29	American Wonder....	309	19	253	..
14	I.X.L.....	354	38	385	..	30	Reeves' Rose.....	298	48	312	24
15	Cambridge Russet....	351	7	334	24	31	Early Rose.....	275	53	299	12
16	Swiss Snowflake.....	349	22	314	36						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Enormous (4 years).....	426	15	352	..	Early Andes (4 years)....	295	54	321	12
Canadian Beauty (4 years)	387	12	332	12	Prolific Rose, (3 years)...	297	..	369	36
Sabean's Elephant (4 years)	330	..	308	..	Pearce (2 years).....	514	48	424	36
Early St. George (4 years)	326	51	391	36	Early Envoy (2 years)....	379	30	352	..
Rawdon Rose (4 years)...	311	33	336	36	Pingree (2 years).....	349	48	374	..

The average crop of the forty-one varieties of potatoes on the Experimental Farm at Nappan in 1904 was 360 bus. 16 lbs. per acre.

POTATOES—*Continued.*

AVERAGE YIELD AT THE EXPERIMENTAL FARM, BRANDON, MAN

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Bus.	Lbs.	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	Late Puritan	463	50	847	..	17	Carman No. 1	407	..	517	..
2	State of Maine	459	48	542	40	18	Country Gentleman	406	16	550	..
3	Delaware	458	0	487	40	19	American Giant	403	20	553	40
4	Money Maker	455	24	634	20	20	Carman No. 3	402	36	531	40
5	Seedling No. 7	454	40	528	..	21	Reeves' Rose	398	56	407	..
6	American Wonder	454	40	546	20	22	Holborn Abundance	396	..	524	20
7	Cambridge Russet	442	56	509	40	23	Penn Manor	368	52	429	..
8	Maule's Thoroughbred	437	4	568	20	24	Early White Prize	368	8	264	..
9	Uncle Sam	433	24	550	..	25	Swiss Snowflake	363	..	462	..
10	Rose No. 9	431	56	561	..	26	Clay Rose	360	4	458	20
11	Empire State	430	28	546	20	27	Everett	357	52	366	40
12	I.X.L.	424	36	495	..	28	Early Rose	322	18	282	20
13	Irish Cobbler	423	8	539	..	29	Bovee	316	48	352	..
14	Dreer's Standard	422	56	648	..	30	Rochester Rose	316	4	465	40
15	Burnaby Mammoth	419	28	355	40	31	Vick's Extra Early	308	44	326	20
16	General Gordon	418	..	528	..						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Enormous (4 years)	526	10	495	..	Early Andes (4 years)	297	55	330	..
Sabean's Elephant (4 years)	475	45	605	..	Prolific Rose (3 years)	503	33	656	20
Canadian Beauty (4 years)	456	30	557	20	Pearce (2 years)	458	20	509	40
Rawdon Rose (4 years)	372	10	315	20	Early Envoy (2 years)	293	20	315	20
Early St. George (4 years)	348	20	230	..	Pingree (2 years)	227	10	341	..

The average crop of the forty-one varieties of potatoes on the Experimental Farm at Brandon in 1904 was 481 bus. 16 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Bus.	Lbs	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	Carman No. 1	504	38	314	36	17	Seedling No. 7	422	36	330	..
2	American Giant	494	51	391	36	18	I. X. L.	418	1	239	48
3	American Wonder	483	44	345	24	19	Dreer's Standard	413	42	352	..
4	Uncle Sam	471	27	420	12	20	Everett	400	40	312	24
5	Country Gentleman	460	29	371	48	21	Irish Cobbler	397	59	305	48
6	General Gordon	456	25	393	48	22	Reeves' Rose	396	24	374	..
7	State of Maine	453	18	369	36	23	Vick's Extra Early	380	31	321	12
8	Delaware	447	14	323	24	24	Swiss Snowflake	380	18	259	36
9	Penn Manor	446	39	435	36	25	Maule's Thoroughbred	366	10	281	36
10	Burnaby Mammoth	444	27	345	24	26	Money Maker	364	18	371	48
11	Rose No. 9	443	12	314	36	27	Cambridge Russet	364	12	226	36
12	Empire State	441	50	275	..	28	Clay Rose	353	15	237	36
13	Rochester Rose	437	49	305	48	29	Bovee	351	5	244	24
14	Late Puritan	433	2	404	48	30	Early White Prize	340	16	279	24
15	Holborn Abundance	429	48	327	48	31	Early Rose	322	14	288	12
16	Carman No. 3	427	48	343	12						

POTATOES—*Concluded.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, N.W.T.—*Con.*

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Sabean's Elephant (4 yrs).	394	33	409	12	Rawdon Rose (4 yrs).....	294	15	226	36
Canadian Beauty (4 yrs)..	393	4	257	24	Prolific Rose (3 yrs).....	389	33	374	..
Early St. George (4 yrs)..	365	12	631	24	Pingree (2 yrs).....	359	2	360	48
Enormous (4 yrs).....	341	23	314	36	Early Envoy (2 yrs).....	350	14	374	..
Early Andes (4 yrs).....	301	27	228	48	Pearce (2 yrs).....	340	20	323	24

The average crop of the forty-one varieties of potatoes on the Experimental Farm at Indian Head in 1904 was 331 bus. 50 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1904.	
		Bus.	Lbs.	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	Uncle Sam.....	421	33	528	..	17	Late Puritan.....	339	19	393	48
2	Rose No. 9.....	399	51	492	48	18	Early Rose.....	338	40	391	36
3	Rochester Rose.....	393	23	435	36	19	American Giant.....	337	5	312	24
4	Swiss Snowflake.....	387	49	409	12	20	State of Maine.....	336	49	402	36
5	Cambridge Russet.....	383	43	435	36	21	I.X.L.....	334	44	453	12
6	Seedling No. 7.....	380	23	448	48	22	General Gordon.....	333	18	422	24
7	Reeves' Rose.....	377	58	422	24	23	Empire State.....	332	34	440	..
8	Country Gentleman...	376	12	456	30	24	Money Maker.....	329	45	215	36
9	Holborn Abundance..	366	47	457	36	25	Everett.....	321	56	361	8
10	Clay Rose.....	363	20	426	48	26	Delaware.....	316	11	325	36
11	American Wonder....	355	48	396	20	27	Maule's Thoroughbred.	314	43	237	36
12	Dreer's Standard.....	353	19	378	24	28	Penn Manor	307	34	376	12
13	Carman No. 1.....	349	38	356	44	29	Carman No. 3.....	288	25	288	12
14	Vick's Extra Early....	346	38	404	48	30	Irish Cobbler.....	278	53	270	36
15	Bovee.....	342	57	305	48	31	Early White Prize....	272	38	206	48
16	Burnaby Mammoth...	339	54	320	52						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1904.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Early St. George (4 years)	419	40	299	12	Early Andes (4 years)....	330	25	290	24
Enormous (4 years).....	412	30	572	..	Prolific Rose (3 years)....	374	10	431	12
Sabean'sElephant(4 years)	400	25	471	8	Pearce (2 years).....	380	2	415	16
Rawdon Rose (4 years)...	397	6	479	36	Early Envoy (2 years)....	226	36	226	36
Canadian Beauty (4 years)	340	19	308	..	Pingree (1 year).....	176	..	176	..

The average crop of the forty-one varieties of potatoes on the Experimental Farm at Agassiz in 1904 was 376 bus. 40 lbs. per acre.

SUMMARY.

The results obtained from the uniform trial plots as given in this bulletin show that there are marked differences in the relative productiveness of varieties even when grown side by side under similar conditions. The results of the average crops obtained for five years indicate also that the tendency to productiveness is in many instances persistent, manifesting itself under varying conditions of soil and climate to a remarkable degree. The establishment of such facts points to the importance of farmers choosing for seed those varieties which give the heaviest crops, so that farming in Canada may thus be made more profitable.

In this bulletin the arrangement of the matter has been modified so as to present in a more prominent way the average figures of a test of five years, the results of the current year occupying a more subordinate position. The plan adopted in this issue shows at a glance the relative position, in regard to productiveness, of all the varieties which have been under trial for five years.

During the past year the number of varieties under test has been further reduced by dropping some of those which have failed to come up to the high standard required. This reduction in the number tested will serve to give greater prominence to those varieties of the highest excellence.

ANNUAL DISTRIBUTION OF SAMPLES OF SEED GRAIN.

Provision has been made in connection with the annual distribution of samples for the improvement of seed to have available considerable quantities of the very best and most productive sorts, so that every farmer in Canada who applies in good season (before March 1) may obtain a sample of such sort as he may desire; but only one sort can be sent to each applicant. These samples are sent free by mail, in cotton bags, the spring wheat and barley in quantities of 5 lbs. each and oats in bags containing 4 lbs. each, enough in each case to sow one-twentieth of an acre. Instructions accompany each sample. In many instances the 5-lb. samples of wheat and barley have, when properly cared for, produced, by the end of the third season, from 100 to 200 bushels of grain, while in the case of oats such quantities have been available by the end of the second season, showing that with proper attention any farmer, under this liberal provision, may soon provide himself with the best and most productive strains of seed in sufficient quantities to sow a large area, at no cost to himself beyond his own labour.

That the farmers of this country avail themselves of this liberal arrangement is evident from the fact that the number of samples now supplied to individual applicants amounts to from 35,000 to 40,000 each year, and the demand is increasing. A steady improvement is taking place in the quality of the cereals produced in this country as well as a large increase in the output, results which are believed to be in large measure due to the more general cultivation of improved and more productive sorts brought about by these annual distributions.

S
133
.E22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

THE POTATO AND ITS CULTURE

WITH LISTS OF

VARIETIES FOUND MOST USEFUL

BY

W. T. MACOUN
Horticulturist of the Central Experimental Farm

BULLETIN No. 49

APRIL, 1905

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

THE POTATO AND ITS CULTURE

WITH LISTS OF

VARIETIES FOUND MOST USEFUL

BY

W. T. MACOUN
Horticulturist of the Central Experimental Farm

BULLETIN No. 49

APRIL, 1905

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

To the Honourable
The Minister of Agriculture.

SIR,—I beg to submit for your approval Bulletin 49 of the Experimental Farm series on 'the Potato and its Culture,' which has been prepared under my direction by Mr. W. T. Macoun, Horticulturist of the Central Experimental Farm.

The potato crop is everywhere one of great importance to the community. In this bulletin there are presented in convenient form the results gained through a long course of experiments, regarding the quality, productiveness and general usefulness of the best sorts of potatoes which have been under trial. The best methods of preparing the land for this crop, of planting and cultivating are fully explained, particulars are also given as to the most successful remedies which have been adopted for the destruction of the injurious insects which attack this plant and for the diseases which affect the vines and tubers.

The ease with which new varieties of potatoes are produced from seed has resulted in the origination during the past few years of a large number of new sorts. All those of special promise have been tested, and their relative merits compared, especially as regards their productiveness, quality and earliness of maturing. During the past eighteen years over 800 varieties have thus been carefully tried, and all those of an inferior character discarded. This epitome of the work which has been carried on at the experimental farms with the potato is but an example. Similar work has been done with all the more important farm crops.

It is hoped that the information given in this bulletin will serve as a useful guide to farmers and gardeners in all parts of this country, and by indicating the most productive and desirable sorts of potato to plant, will lead to a large increase in the average crop, an improvement in the quality of the tubers produced, and that thus increased profits may be realized by the growers.

I have the honour to be,
Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, April 1, 1905.

THE POTATO AND ITS CULTURE

BY

W. T. MACOUN,

Horticulturist, Central Experimental Farm, Ottawa.

Although the potato is one of the most important food products of Canada, the methods of culture employed in growing this crop can be very much improved. This bulletin is published for the purpose of giving information to Canadian farmers, which should help them to obtain much better crops than they have hitherto had. The recommendations made are for the most part based on the results of experiments conducted at the Central Experimental Farm during the past seventeen years, although the results of the work of other experimenters have not been overlooked, and have also been used when deemed advisable.

The production of potatoes in the largest producing countries of the world is very great. In 1901, when the last census was taken, the crop in Canada was 55,362,635 bushels. The estimated crop for the United States for the year 1904 was 332,830,300 bushels.

In the chief potato growing countries of Europe and in Great Britain and Ireland the following enormous quantities of potatoes are produced:—

	Bushels.
1904—Great Britain and Ireland	232,596,821
1902—Germany	1,596,518,586
1902—Russia	1,008,721,619
1901—Austria	436,986,819
1901—France	236,469,441
1901—Hungary	178,158,782

This immense production has come about chiefly from the fact that the potato has been found to be one of the cheapest foods that can be obtained. Its popularity has, moreover, been maintained by its palatability, for although closely related to some poisonous species, and under certain conditions more or less poisonous itself, the potato when properly grown is one of the most palatable articles of diet. Being without any decided flavour, it is disliked by few, and for this very reason it is a food of which few persons tire, being in this respect much like bread.

In addition to its direct food value, the potato is used in large quantities for the production of starch, glucose and alcohol.

Potato culture in Canada.—The potato is used almost as freely as bread in Canada and like that food, is thought as much of by the rich as by the poor. It can be obtained at all seasons of the year, and if properly kept is about as good at one time as at another. Being one of the most useful food products, its culture and improvement deserve the greatest attention.

The potato succeeds well everywhere in this country where the season is long enough for the tubers to develop before the tops are killed by frost, hence potatoes are cultivated in practically every settlement in Canada, even the inhabitants of Dawson City being able to grow potatoes.

There is no farm crop, in our judgment, which will repay good culture as well as the potato, nor any of which the crop can be increased so much by one season's work. A few more bushels per acre can be added to the wheat and oat crop by careful hus-

bandry, and the crop of turnips and mangels increased also, but the percentage of increase is much less than with the potato. The average yield per acre for the Province of Ontario for the year 1904 was 116 bushels, and for the past twenty-two years 115 bushels. According to the census of 1901, the average yield per acre for the whole of Canada was only 123·37 bushels, the province giving the highest yield being Prince Edward Island with 149·28 bushels. But the yield in Canada is considerably better than that of the United States, which, according to the census of 1899, was only 88·6 bushels per acre. Some of the best farmers in Canada have grown from 400 to 500 bushels per acre, and 300 bushels per acre is not at all unusual. At the Central Experimental Farm, Ottawa, the highest yield has been at the rate of 772 bushels per acre, but it has been proven by careful experiment that potatoes can be produced at the rate of over 1,000 bushels per acre, an actual and authentic experiment having shown that from a one-twentieth acre plot potatoes were grown at the rate of 1,061 bushels per acre. There have also been other cases where yields at the rate of 1,000 or more bushels per acre have been obtained. While in field culture such high yields may not be possible, they are something to strive for and there is no doubt that the average yield for Canada could be doubled if the best methods were employed by every grower.

Experiments with Potatoes at the Central Experimental Farm, Ottawa.—When work was begun at the Central Experimental Farm in 1887, the importance of the potato crop was not forgotten, and experiments were begun at that time and have been continued ever since in order to gain information which might be used to improve the crops of potatoes in Canada. The first work done was to bring together at the Central Experimental Farm a large number of varieties for comparison of productiveness, quality, and freedom from disease. In the year 1887, there were 245 varieties tested, most of them having been obtained from Germany, where the largest number were offered for sale. New kinds have been added from time to time since then and many of the old ones have been discarded, but during the past seventeen years 560 named varieties have been tested. The results of this work will be discussed in the chapter on varieties.

In the year 1888 and in 1890 ,potato seed was sown and 283 different seedlings were raised, and compared with the named varieties. The results of this work will also be found elsewhere in this bulletin. Experiments have been conducted with different kinds of sets, such as whole and cut potatoes of various sizes; in planting the sets at different distances apart; in planting at different depths, and in planting at different dates. Level and hill culture have also been compared. Experiments in spraying with different fungicides and insecticides for the prevention of blight and destruction of insects have likewise been among the important experiments carried on, and some of the results of these tests will be found in this bulletin. There have also been experiments with fertilizers. What is considered one of the most useful lines of work with potatoes has been the distribution of samples of the best varieties free to farmers throughout the country. This distribution was begun in 1891 and is being continued. From 1891 to 1904 inclusive, there have been, 65,832 3-lb samples sent out. These, going to many farmers scattered through all parts of Canada, must have influenced the production and helped to increase the crop of potatoes very much.

DESCRIPTION AND HISTORY OF THE POTATO.

The potato *(Solanum tuberosum)* is a berbaceous perennial belonging to the *Solanacæ* or Night Shade family, a large order containing 800 or more species, of which only six are tuber-bearing. The cultivated potato is a native of the elevated parts of Chili, Peru and probably Mexico. It is believed that the potato was introduced into Europe first from America by the Spaniards during the latter part of the 16th century, but in 1586, a few years later, Sir Walter Raleigh or some of his colonists brought it from America to Ireland. The tubers were planted on Sir Walter Raleigh's estate at Youghall near Cork, and the cultivation of potatoes extended from this place among

the poorer Irish classes and also in England. In 1663 the Royal Society of England endeavoured to encourage the growth of potatoes as a cheap food in case of famine, but at that time they were not highly regarded and the potato was not recognized generally as an article of food for man until the middle of the 18th century or about 150 years ago, when a famine in Scotland in 1743 brought it into prominence as a cheap food and gave a great impetus to its culture. European countries had been just as slow to recognize the merits of the potato, for it was not until 1771, when a prize was offered in France for the discovery of a food that could take the place of wheat in the case of famine, that the potato came into prominence in that country. Parmentier, an apothecary, who brought forward the potato, was rewarded by the gift of 50 morgen of land from Louis XVI. During the 19th century the popularity of the potato increased rapidly in the United Kingdom and Europe, and with it the production grew in proportion.

In America the settlers used the potato to some extent for food during the 17th century, and as its value became appreciated it was grown in ever increasing quantities.

IMPROVEMENT OF THE POTATO.

The potato, like most other plants taken from a wild state, or where cultivation has been rude, improves with good culture. In its wild condition the potato does not grow nearly as large as when in cultivation, the tubers are borne nearer the surface of the soil and sometimes appear on it. Those thus exposed turn green and are unfit for food. Where they grow deep enough in the soil to be at all edible, they are watery and insipid. The wild potato varies both in the colour of its blossoms and tubers, the latter ranging from red to white.

The first good description of the potato under cultivation was made by de l'Ecluse, a noted French botanist, in 1601, who described it under the name of *Papas Peruanorum*. In his description he wrote that one tuber yielded as many as 50 tubers of unequal size from one to two inches long, irregularly ovoid and reddish. The flower was more or less pink externally and reddish within. He sowed seeds, which produced a white-flowered variety.

The potato has steadily improved in size and quality since the seventeenth century, and the potato of to-day is quite different from what it was at that time. This improvement has been brought about by originating new varieties from the best of the old ones and by better methods of culture.

VARIETIES.

The number of named varieties of potatoes is very large. A catalogue was published in 1886 by Henry L. de Vilmorin, Paris, France, in which names of 840 varieties are given, and this list represents but a small proportion of the number which have been named since the potato was first cultivated. The varieties of potatoes vary much in productiveness, season, quality, size, shape and colour, and even in resistance to disease, and this variability is taken advantage of where potatoes are grown for special purposes. A variety is considered fixed when it remains fairly true to the original description of it. Varieties may be grouped here into a few well-defined shapes, such as roundish, oblong, and long, although these might be subdivided into many others if perfect accuracy in description of shape were desired. There are great differences in taste as regards the flesh and quality of potatoes. The flesh of potatoes may be described as watery, waxy or soapy, and mealy, and white or yellow in colour. In some parts of Europe, and even in Great Britain, a waxy potato is preferred to a mealy one, and a yellow-fleshed to a white-fleshed one, but in Canada nearly everyone prefers a white-fleshed, mealy potato, which will go to pieces when properly cooked. The profitable life of a potato is given by the best authorities at the present time as

from 12 to 15 years. This was also thought to be the limit of a potato's usefulness one hundred years ago. As appearing to confirm this, it is interesting to note that of the 12 varieties of potatoes which have averaged best in yield for the past five years, only one, the Rural Blush, which is ninth on the list, has been under test more than 12 years, although there were 9 varieties grown in the experimental plots in 1904 which had been under test for over 12 years, and which have continued to compare favourably in productiveness with the best of the newer sorts. Just how far change of seed would help to keep up the productiveness of the variety is not yet thoroughly understood, but from some experience we have had we are led to believe that under certain conditions the productiveness will be retained, and perhaps increased, by a change of seed. This matter is discussed further under 'Change of Seed.'

Varieties of potatoes may be originated in three different ways :—

SEEDLING VARIETIES.

By far the largest proportion of varieties of potatoes have been grown from seed In the autumn when the potato vines have died, the green seed balls, or potato apples as they are sometimes called, may be found. These balls contain the seeds, which are imbedded in a mass of pulp, which may be mashed and the seeds washed out. In early spring these may be planted in the greenhouse or hot-bed, like tomato seeds, and when the young plants are large enough they may be pricked out and planted in pots. When the season for outdoor planting arrives they are taken from the pots and planted with the earth attached. They may then be treated as ordinary potato plants, although, being smaller, should be cared for better. The vines being very tender, are more subject to the attacks from injurious insects than ordinary varieties. In the autumn, potatoes will be found in each hill, ranging in size from a marble to a hen's egg. Each plant will produce a different variety of potato. In order to start from a good basis, only the uniform and best potatoes should be kept from each plant, and if there is only one tuber satisfactory in this respect it only should be retained. The next season, potatoes are produced almost or quite as large as older varieties, but it will not be until the third or fourth year that the full value of the variety will be known. When the crop the second season is dug the best potato or potatoes should be taken from the most productive hill, and the rest discarded, and this should be continued even to the third and fourth year until the type is fixed. In 1888 there were 237 seedlings grown at the Central Experimental Farm, and 46 others added in 1890. By 1893 only 24 of these varieties were considered worth keeping. While two of these were continued until 1902, they were finally discarded as not being equal to the many other named varieties which were being tested. Thus, out of 283 seedlings not one was found equal to some already on the market. This failure to originate a good variety out of so many was probably partly due to the fact that the seed must have been taken from kidney varieties, as a large proportion of the seedlings were kidney shaped and fine-looking, but lacked productiveness, like most of the kidney potatoes which have been tested at Ottawa. Seed taken from productive varieties of good shape and quality is likely to produce a small proportion of seedlings of merit. It is difficult to obtain seed nowadays from the best varieties, as there is little seed produced. This is no doubt due to the fact that the potato is propagated year after year from the tubers, and as the tuber-producing power of the potato increases, the organs of seed production are weakened and in most varieties refuse to produce seed at all. This non-production of seed is not, however, a thing of recent years only, although the introduction of early varieties which produce the least seed has made the fact more apparent.

In 1824, Loudon, in describing ten of the earliest varieties of potatoes which were in general cultivation at that time, writes: 'No blossoms are produced by any of the above sorts.' An interesting experiment conducted by Knight in 1806 is also given by the same author. Knight wished to find if the cause of no seeds being produced was owing to the increased production of the tubers, and writes thus of his experi-

ment: 'I suspected the cause of the constant failure of the early potatoes to produce seeds to be the preternaturally early formation of the tuberous root which draws off for its support that portion of the sap which in other plants of the same species affords nutriment to the blossoms and seeds, and experiments soon satisfied me that my conjectures were perfectly well founded. I took several methods of placing the plants to grow in such a situation as enabled me to readily prevent the formation of tuberous roots, but the following appearing the best it is unnecessary to trouble the society with an account of any other. Having fixed strong stakes in the ground, I raised the mould in a heap round the bases of them and in contact with the stakes; on their south sides I planted the potatoes from which I wished to obtain seeds. When the young plants were about four inches high, they were secured to the stakes with shreds and nails and the mould was then washed away, by a strong current of water from the bases of their stems, so that the fibrous roots only of the plants entered the soil. The fibrous roots of this plant are perfectly distinct organs from the runners which give existence and subsequently convey nutriment to the tuberous roots; and as the runners are wholly out of the soil, the formation of tuberous roots is easily prevented; and whenever this is done numerous blossoms will soon appear, and almost every blossom will afford fruit and seeds.' This experiment is recorded at some length here, as it is the only one of its kind that has come under the writer's notice, and it may prove suggestive to potato breeders in America.

CROSS-BRED VARIETIES.

Although it is quite possible to artificially cross varieties of potatoes just as other vegetables are crossed, very little of this work has been done, the principal reason being that pollen is so difficult to find and breeders have for the most part been content to raise seedlings from seed gathered in the field. Special seed, said to have been obtained by cross-breeding, is sometimes advertised, but it may be safely stated that in most cases this seed was not produced by hand pollination. Cross pollination, no doubt, takes place in the field, which is brought about by the agency of wind and insects, and in the seedlings from seed produced in such a field some characteristics of the varieties which were growing in the field will, no doubt, be apparent.

VARIETIES ORIGINATED BY BUD VARIATION, OR 'SPORTS.'

It has been said that varieties of potatoes 'mix in the hill.' This erroneous impression prevails among some people from the fact that occasionally a tuber will be produced by a plant which differs in colour, or perhaps in other respects from all the rest of the potatoes in the hill. This sporting, though not common, is found among other species of plants which occasionally produce branches bearing variegated leaves or different coloured flowers or fruit from the type. The potato tuber is a swollen underground stem and is just as likely to sport as any other stem. This so-called mixing is usually supposed to be caused by varieties crossing in the field, thus causing different coloured tubers to form the same season in the same hill. This, however, at least from present knowledge, is not the case.

VARIETIES CHANGED OR IMPROVED BY SELECTION.

After a variety has been originated in any of the three ways already described and after its general characteristics have been sufficiently fixed to introduce it, a variety may be so changed by careful selection that it would not be recognized later on if compared with the original in field culture. This selection may be undertaken for the purpose of increasing the yield, or to obtain a variety which is earlier or later, shallower in the eye and of better shape; it may also be undertaken to obtain a potato which is more resistant to disease, better in quality, or with a higher percentage of starch.

When the variety or varieties to be improved have been decided upon, the sets are planted in the ordinary way or a little further apart in the rows. At digging time

the best potato from the most productive hill is saved and all the others discarded; or the best potato in the hill that is freest from disease; or the best potato from any other standpoint. This best potato is planted the following season and the selection is continued until the characteristics sought for appear fixed. Great differences have been found by experimenters in the yields from different hills of the same variety, and while the work of breeding by selection is comparatively new very striking results have been obtained already.

MOST PRODUCTIVE VARIETIES.

Since the year 1887, variety testing has been one of the chief experiments conducted with potatoes at the Central Experimental Farm. As previously stated, 560 named varieties have been tested since that time. Each year the different sets are grown side by side under as nearly uniform conditions as possible, and the yields are carefully recorded when the crop is dug. If, after giving it a thorough test, a variety is found to not be sufficiently productive, to be of undesirable shape and appearance, or of inferior quality, it is discarded. New kinds are constantly being tested. In the following table a list will be found of the twelve varieties of potatoes out of an average of 110 tested yearly which have averaged highest in productiveness for the past five years, with descriptive notes regarding them.

As an example of the importance of planting the most productive varieties, it may be stated that during the past five years the average yield per acre of the heaviest yielding variety of each year was 596 bushels 12 pounds, and of the poorest yielding variety, 135 bushels 58 pounds, a difference of 460 bushels 14 pounds per acre. In the year 1904 the difference between the heaviest yielding variety, the Vermont Gold Coin, and the poorest, the Bliss Triumph, was 431 bushels 12 pounds per acre. Even in the list of twelve varieties given in the following table there is a difference in yield of 63 bushels 21 pounds per acre between the first and twelfth. The yields given in these tables are higher than would be obtained in field culture, as these potatoes were grown on comparatively small plots:—

TWELVE Most Productive Varieties of Potatoes—Average of 5 Years, 1900–1904.

Number.	Name of Variety.	Number of Years under Test.	Season.	Approximate Relative Freedom from Late Blight. Scale of 10 Points.	Shape.	Colour.	Depth of Eyes.	Quality.	Average Yield Per Acre, 1900-04.	
									Bush.	Lbs.
1	Dr. Maerker	6	Very Late	10	Roundish	White	Medium to deep	Med. to good	496	19
2	Late Puritan	11	Late	9	Long to oblong	"	"	Good	485	19
* 3	Burnaby Mammoth	12	Medium	10	"	Pink and white	"	"	483	34
4	Money Maker	10	"	6	Long	White	Shallow	"	482	41
5	Carman No. 1	10	"	10	Round to oblong	"	" to medium	"	459	48
† 6	Dreer's Standard	11	Late	9	"	"	" "	"	458	55
7	Sabean's Elephant	10	"	9	Oblong to long	"	Medium	"	454	58
8	Canadian Beauty	7	Medium	5	"	Pink and white	"	"	452	46
9	Rural Blush	16	Late	10	Roundish flattened	Pink and reddish	"	"	437	48
10	I.X.L.	12	Medium	4	Oblong to long	Pink and white	"	"	433	50
11	Pearce	5	"	3	"	"	"	"	433	24
12	Clay Rose	10	Late	10	Roundish to oblong	Deep pink	"	Medium	432	58

* This variety was first grown under the name of Burnaby Seedling and then procured under the name of Burnaby Mammoth. The average yield from the older strain for four years and the new one for one year is 469 bushels 29 lbs.

† This variety is not the Dreer's Standard now being advertised as Dreer's Extra Early Standard which is a later introduction.

In the above table it will be noticed that none of these varieties are early, the experience at Ottawa having been that if properly sprayed the best medium and late varieties will nearly always yield better than the early ones. A glance at the table of best yielding early varieties shows that there is an average difference of 64 bushels 14 pounds per acre in favour of the most productive late variety. It is significant, also, that seven of the twelve most productive varieties are also among the twelve most blight resistant. The next point worthy of notice is that out of the twelve most productive varieties, only one, the Dr. Maerker, is of European origin, although many from Europe and Great Britain have been tested. We believe that our season is too short for most varieties from Great Britain, and Europe, and hence, as a rule, they are not so productive as those of American origin. The Dr. Maerker, though very late, is also very blight resistant, and being naturally productive, is able to produce a heavy crop. The Dr. Maerker is not attractive in appearance nor as good in quality as the other varieties in the list.

In addition to the twelve varieties in the table, the Uncle Sam may be mentioned as a very productive, good sort, which almost came into the list of best twelve. There are also three other newer kinds under test which have proven very productive, namely: Vermont Gold Coin, Dooley and Morgan's seedling. Vermont Gold Coin in particular is worthy of special notice. It is in appearance somewhat like Carman No. 1, and appears especially resistant to blight.

MOST PRODUCTIVE EARLY VARIETIES.

There has been a large number of early varieties of potatoes tested at the Central Experimental Farm during the past seventeen years. As soon as a variety has been grown long enough to judge of its merits it is usually discarded if it has not proven productive. Even although a variety is a fairly good yielder if it does not average as well as another of the same type or one very much like it, it is usually discontinued. An exception, however, is made in the case of early kinds which, although not as productive as others nor so early, are sometimes retained on account of their extreme earliness, but among these extra early ones, also, the most productive variety of a certain type is usually kept and the poor yielding ones discarded. In the following table will be found a list of the six early varieties which have yielded best on the average for the past five years.

Six Most Productive Early Varieties of Potatoes—Average 1900–1904.

Name of Variety.	No. of Years under Test.	Season.	Shape.	Colour.	Depth of Eyes.	Quality.	Average Yield Per Acre 1900–1904.	
							Bush.	Lbs.
1 Irish Cobbler.....	8	Early.....	Roundish.....	White.....	Medium..	Good...	432	5
2 Early Elkinah.....	5	"	Oblong to long	Pink.....	" ..	" ...	416	14
3 Vick's Extra Early...	13	"	" "	Pink and white	" ..	" ...	412	17
4 Rochester Rose.....	10	Extra early.	" "	Pink.....	" ..	" ...	409	53
5 Reeves Rose.....	8	Early.....	Oblong.....	"	" ..	" ...	401	17
6 Rawdon Rose.....	8	"	"	Pink and white	" ..	" ...	383	41

Although it will be seen by comparing the above table with the table of most productive varieties that the early ones do not yield as well as the best of the medium and late ones, there is always a great demand for early potatoes and it is important to know which are the most productive. In order to show the value of testing some of the newer early varieties, let us compare the yield of the Early Rose, one of the best known old early standard sorts, with the most productive of the newer ones. Take, for example, the Early Elkinah, which is much like the Early Rose in appearance.

This has averaged at the rate of 416 bushels 14 pounds per acre for the past five years, while the Early Rose has only averaged 345 bushels 24 pounds, a difference of 70 bushels 50 pounds per acre. There are two well known varieties which might have appeared in the above table if they had been grown in 1904, namely, the Early Norther and Burpee's Extra Early. The Early Norther yielded an average crop for the four previous years of 411 bushels 24 pounds per acre, but was discontinued, as the Rochester Rose, which resembles it very much, proved more productive. The Burpee's Extra Early yielded an average crop from 1900-1903 of 409 bushels 12 pounds per acre. The Vick's Extra Early, a variety resembling it, yielded better, hence Burpee's Extra Early was not grown in the comparative plots in 1904. New seed, however, has been procured and it will be given a further trial as it is earlier than Vick's Extra Early and on this account more valuable as an extra early sort. Among long, white skinned early potatoes, the Polaris, Early Puritan, and Early White Prize have proven the most productive and desirable, but have not averaged as well as any of those in the table.

Other newer early varieties tested for a short time which have proven productive are, Quick Crop and Northern Beauty.

EXTRA EARLY VARIETIES OF POTATOES.

For four years, digging tests have been made to determine which varieties of potatoes were fit for market soonest. In three years out of the four, the potatoes were dug twice each week, and in one year once each week, beginning from six to eight weeks after planting, depending on the season, and continuing through the month of August. Notes were taken on the number of potatoes produced by each variety at each digging, the size of the largest potatoes and the number that were marketable. Following are notes on some of these extra early varieties:—

Snowball.—This is a roundish, white potato with medium to deep eyes and of good quality which has been grown for the past three years. It appears to be the earliest variety yet tested, but is not a heavy cropper.

Eureka Extra Early.—This variety is very similar to Snowball and apparently nearly as early.

Burpee's Extra Early.—One of the best extra early kinds. It is almost as early as Early Snowball and Eureka Extra Early and much more productive. It is oval or oblong in shape, pink and white in colour, with eyes of medium depth. The quality is good. This, and the Rochester Rose, are the most productive extra early kinds tested at the Central Experimental Farm and where productive extra early potatoes are required these are among the best. The Bovee and Thorburn are very similar to Burpee's Extra Early but neither of them has proven so productive. The Vick's Extra Early is more productive, but is not nearly as early.

Rochester Rose.—The Rochester Rose is a pink potato of the Early Rose type, but is earlier and much more productive than that old favourite. This and the Burpee's Extra Early are the two most productive extra early varieties tested at Ottawa.

Bliss' Triumph.—This variety and the Stray Beauty are very similar if not identical. It is a very early kind, but a poor yielder, and the quality of the young potatoes is not as good as some others.

Early Ohio.—The Early Ohio is an old favourite and well deserves the praise which it has had in the past. It is about as early as any, and the new potatoes are drier than most other early kinds. The Early Andes, Early Six Weeks, Early Dawn, and Early Market, are all of this type. None of these have proven as productive as Burpee's Extra Early and Rochester Rose, which are the two varieties which we should recommend.

BLIGHT AND ROT PROOF VARIETIES.

The Late Blight and Rot which some seasons causes serious injury in certain parts of Canada and always lessens the crop more or less, is causing inquiry to be made among farmers as to the possibility of obtaining varieties which are resistant to it. So much interest has been created in this subject during recent years that in Great Britain a National Potato Society has been formed, one of the principal aims of which is to gather information regarding the Late Blight of potatoes and to further the introduction of varieties which are the most immune from this disease. At the Central Experimental Farm notes are taken each year on the time when the tops of the different varieties die. In this way it has been possible to obtain fairly accurate information as to their relative blight resistance. It is true that the vines of these varieties were sprayed with Bordeaux mixture most of the years when these notes were taken, but the average results are confirmed in most cases by notes taken of the varieties when they had not been sprayed. So that it may be fairly stated that the varieties given in the following table are the most blight resistant as far as foliage is concerned. The relative rotting in the cellar has not been recorded, but the relative rotting in the field before digging has been and confirms the notes on the blighting of the tops. In the following table the approximate relative freedom from blight is given of the twelve most productive blight resistant kinds :—

TWELVE Varieties of Potatoes, Freest from Late Blight—Average of 5 Years, 1900–04.

Number.	Name of Variety.	Season.	Number of Years under Test.	Approximate Relative Freedom from Late Blight. 10 Points.	Shape.	Colour.	Depth of Eyes.	Quality.	Average Yield Per Acre, 1900-1904.	
									Bush.	Lbs.
1	Dr. Maerker	Very late	6	10	Roundish	White	Medium to deep	Med. to good.	496	19
2	Late Puritan	Late	11	8	Long to oblong	"	Medium	Good	485	19
3	Burnaby Mammoth	Medium	12	8	"	Pink and white	"	"	483	34
4	Carman No. 1	"	10	8	Roundish to oblong	White	Shallow to medium	"	459	48
5	Dreer's Standard	Late	11	8	" "	"	"	"	458	55
6	Sabean's Elephant	"	10	8	Oblong to long	"	Medium	"	454	58
7	Rural Blush	"	16	9	Roundish flattened	Pink and reddish	"	"	437	48
8	Clay Rose	"	10	8	" to oblong	Deep pink	"	Medium	432	58
9	Rose No. 9	"	8	8	Oblong to long	Red	"	"	406	34
10	Holborn Abundance	Very late	16	10	Roundish	White	Medium to deep	"	406	7
11	State of Maine	Late	15	9	Oblong to roundish	"	Medium to shallow	Good	404	48
12	Swiss Snowflake	"	7	9	Roundish to oblong	"	Med. to rather deep.	"	399	31

While the varieties in the preceding table are probably not entirely blight proof, they are certainly not so much affected by it as others. The Dr. Maerker has been grown for six years and it has shown practically no sign of blight, the vines being usually green at digging time. The same may be said of the Holborn Abundance, which has been very free of blight, although grown at the Central Experimental Farm for sixteen years.

It will be seen by consulting the table that ten out of the twelve varieties are late or very late kinds. The remaining two might also be classed as medium to late. This would indicate that it is the late varieties which are most blight resistant. Many late kinds, however, are badly affected with blight.

Two other varieties which are very free of blight, but which have recently been discarded, are Dakota Red and Green Mountain; the former, on account of its inferior quality, and the latter because it was not so productive as some others. Other varieties which are also comparatively free of blight are American Wonder, Enormous, Sir Walter Raleigh and Uncle Sam, all late kinds. The Vermont Gold Coin, a very promising variety tested for only two years, also appears to be very blight resistant.

VARIETIES AS AFFECTED BY CHANGE OF SEED.

Much has been said and written both in favour and against change of seed, but the prevailing opinion among farmers is that a change of seed is beneficial. There is very little accurate information available on this subject, particularly in regard to potatoes. The writer is inclined to take the view that sometimes a change is beneficial and sometimes it is not, the conflicting results which have been obtained leading one to this conclusion. If a variety is succeeding well on a farm or in a district, it is evident that the conditions suit it and we believe that it is wise after a time to get a change of seed from another locality, as with another strain which has been grown under even more suitable conditions than ours, we may get better results. The new seed should, however, be planted alongside the old for comparison before discarding the latter, as the new strain may yield less.

Potatoes which are not fully matured when dug will sometimes produce larger crops the following year than those which are fully matured. This is probably due principally to the fact that they keep better as they do not sprout so early and are in better condition at planting time. At the Central Experimental Farm, potatoes planted on June 23 and even on July 7, 1899, yielded in 1900 more than those planted May 22, 1899. It will, therefore, be seen that in getting a change of seed the maturity of the potatoes may, the first year they are planted, make considerable difference in the yield.

The Carman No. 1 potato is considered one of the best of those grown at Ottawa, and the Carman No. 3, while not averaging so productive, is also good. The former had been grown for ten years without a change of seed and the latter for nine years. In 1904 new seed was obtained from the firm of J. M. Thorburn & Co., New York. Sixty-six sets of the new seed of Carman No. 1 were planted alongside the same number of sets of the old. The new seed yielded at the rate of 501 bushels 36 pounds per acre, and the old at the rate of 435 bushels 36 pounds, a difference of 66 bushels per acre in favour of the new seed. The same number of sets of Carman No. 3 were planted. The two strains were not grown alongside but near each other in almost or quite the same kind of soil and cultivated the same. The new seed of Carman No. 3 yielded at he rate of 435 bushels 36 pounds per acre, or the same as the old Carman No. 1, and the old seed of Carman No. 3 only yielded at the rate of 264 bushels per acre, a difference of 171 bushels 36 pounds per acre in favour of the new seed. If these new strains continue as productive in the future this change of seed will have proved a profitable one. It may be said that the potatoes used each year for seed at the Central Experimental Farm are medium sized tubers, which are cut into pieces having at least three eyes.

Photo. by Frank T. Shutt.

TWELVE MOST PRODUCTIVE VARIETIES OF POTATOES. AVERAGE OF FIVE YEARS TESTS.
CENTRAL EXPERIMENTAL FARM, OTTAWA. [p. 16]

Some attention has been paid to the comparison in yield between northern and southern grown seed potatoes, but the results are so conflicting that they are not given here. It will be seen from what has already been written that there are so many factors governing the results obtained from a change of seed that it would be difficult to tell with certainty whether, all things being equal, northern or southern grown seed is the better. As it is easier keeping northern grown seed from sprouting, on account of the potatoes maturing later, and as sprouting lessens the value of the potato for seed, it is probable that as a rule northern seed would stand a better chance in comparison with southern unless where two crops are raised in the season the second crop from the southern were used, when the southern seed might come out best.

CULTURE.

The Potato Plant.—Before beginning to grow potatoes it is important to know something about the potato plant and its habits in order that it may be cultivated intelligently. Some information has already been given in this direction, but something more may be said here. When a potato plant is growing, four distinct and important forms of vegetation are developed, in addition to flowers and fruit—which need not be discussed here. These are: roots, foliage, stems above ground, and under ground stems or rhizomes on which the tubers are borne. Through the roots the whole plant, including the tubers, obtains its moisture and much of its food in a crude condition. The leaves are, as it were, the lungs of the plant and in them is elaborated or manufactured the plant food which is taken from the soil by the roots and also that which is obtained from the air. The stems are the conductors as well as utilizers of the plant food and are the framework of the plant. The stems also serve another purpose, for from their leaf axils below ground are developed the rhizomes or underground stems, the tips of which become the tubers. As the underground or tuber-bearing stems bear no roots they must depend for their development on the root system of the plant, and the leaves, and the plant food which these bring to them. It will be seen therefore, that it is important to have a good root system and a good leaf development in order to have a good crop of tubers. As a rule the larger the top the larger the crop will be, providing the tubers have a long enough season to develop properly. Occasionally when a very heavy application of a nitrogenous manure is made the crop will not be in proportion to the large tops.

Climate and Soil.—The potato appears to thrive best in a moist, somewhat cloudy and temperate climate, but providing there is sufficient moisture in the soil and the growing season is long enough it is not at all fastidious in this respect. It is a little more particular in the matter of soil, but large crops are grown in a great variety of soils. The ideal soil for potatoes appears to be a rich, deep, friable, warm sandy loam with good natural drainage and well supplied with decayed or decaying vegetable matter. The potato requires a large amount of moisture to develop a large crop of potatoes and for this reason the soil should be retentive of moisture. Potatoes will not, however, succeed well in cold soil where the water is stagnant near the surface and thorough drainage is very essential to a good crop.

Potatoes succeed admirably on new land providing it is well drained and not too stiff, as the soil is filled with decayed vegetable matter and humus which help to make it loose. Such soil retains moisture well, and furnishes nitrogen in a very available form. They succeed well after sod also, as the decaying sod gives somewhat the same conditions as new land. Clay and clay loams are not so suitable to the potato crop as the warmer sandy loams and gravelly soils as they are usually colder and being as a rule, stiffer the tubers are not as even in shape nor as smooth. The quality of the potatoes grown in sandy or gravelly soils is better than those grown in clay or clay loams.

PLANT FOOD REQUIREMENTS AND FERTILIZER EXPERIMENTS.

The average results of a large number of analyses show that a crop of 200 bushels of potatoes, exclusive of the potato tops, which are usually left on the ground, remove from the soil approximately 40 pounds nitrogen, 20 pounds phosphoric acid, and 70 pounds potash. A crop of 25 bushels per acre of wheat, including straw, will remove about 42 pounds nitrogen, 23 pounds phosphoric acid and 40 pounds potash. A crop of 25 bushels per acre of wheat will remove more nitrogen from the soil than 200 bushels of potatoes, and yet we find farmers, as a rule, heavily manuring their soil intended for potatoes with barnyard manure. While no good farmer would apply barnyard manure direct to the wheat crop. It is true that the potato crop takes from the soil nearly twice as much potash as wheat, hence a light dressing of manure is advisable to supply this. In ten tons of manure there would be considerably more potash than the crop of potatoes would take from the soil, but of course this would not be all available for the potato crop.

It has been stated already that potatoes do well when grown after sod, and it will be shown that the results from experiments conducted at the Central Experimental Farm in growing potatoes after clover sod, fully bear out the popular belief and show the wisdom of the practice of the best potato growers.

The following results, taken from the annual reports of Dr. Wm. Saunders, Director of the Dominion Experimental Farms, show the average increase for three years from the ploughing under of clover. The clover was sown with grain at the rate of 12 pounds per acre and ploughed under the following spring shortly before planting and after considerable growth had been made. The variety of potatoes planted in each year was the Everett :—

YIELD PER ACRE OF POTATOES WITH AND WITHOUT CLOVER.

Year.	Yield per Acre with Clover.		Yield per Acre without Clover.		Increase in Yield from the Clover.	
	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
1901 (3 plots averaged)	423	47	391	20	32	27
1902 (3 plots averaged)	391	40	352	40	39	..
1904 (1 plot)	402	..	362	20	39	40
Average increase for three years	.....		.....		37	2

It has been proven by careful experiments conducted at the Central Experimental Farm that the crop of grain is not lessened by sowing clover with it, hence practically the only outlay for the increased crop of potatoes is the price of 12 pounds of clover seed, which at 14 cents a pound is $1.68. Thirty-seven bushels of potatoes sold at 40 cents a bushel, is $14.80; deducting the cost of the clover seed, and the net increase in profit from the ploughing under of the clover would be $13.12. Furthermore, the value of the clover is not all exhausted by the potato crop.

The following extract with tables from Bulletin No. 40, Central Experimental Farm, 'Clover as a Fertilizer,' by Dr. Wm. Saunders, Director, and Frank T. Shutt, Chemist, Dominion Experimental Farms, shows the relative value as plant food of clover and barnyard manure :—

'*Clover Compared with Barn-yard Manure as a Fertilizer.*—At the outset it should be understood that in advocating green manuring with clover, this crop is not brought forward as a material to replace barn-yard manure, but rather to supplement

it and to make its application more effective. Barn-yard manure of good average quality contains about the following proportions of the chief fertilizing constituents :—

Nitrogen	10	lbs. per ton.
Phosphoric acid	5	"
Potash	9	"

An application of ten tons per acre will, therefore, enrich the soil, approximately by the following amounts:—

Nitrogen	100	lbs. per acre.
Phosphoric acid	50	"
Potash	90	"

'The chemical investigations made in connection with these experiments have shown that a vigorous crop of clover will contain, at a moderate estimate, in its foliage and roots :—

Nitrogen	from	100	to	150	lbs. per acre.
Phosphoric acid	"	30	"	45	"
Potash	"	85	"	115	"

'Respecting nitrogen, it is evident that by the use of clover we can with a single crop furnish the soil with as large a quantity as would be supplied by a dressing of 10 tons of manure per acre. The greater part of the nitrogen is gathered by the clover from the air, a source not otherwise available, and is therefore a distinct addition to the soil. The amounts of phosphoric acid, potash, and lime in the clover have, it is true, been obtained from the soil, but have been largely drawn from depths beyond the reach of the roots of ordinary crops. The decay of the clover, moreover, liberates these important fertilizing elements in soluble and available forms, so that they can be readily utilized by the crops which follow.'

As stated in the preceding extract, a large part of the nitrogen contained in a crop of clover is taken from the air, hence it is probable that, when a crop of potatoes is removed, little, if any, exhaustion takes place of the nitrogen which was in the soil before the clover was grown and ploughed under, and as the nitrogen from the decayed leaves and stems of the clover is in a very available condition the potato plant is able to use much of it. It is very important to have the nitrogen in an available condition for a crop with as short a growing season as the potato has in this country.

From what has already been written, it will be readily seen that clover and barnyard manure are two very important and cheap fertilizers for the potato. The former obtains nitrogen from the air and brings up phosphoric acid and potash from great depths in the soil to be available for succeeding crops and in adding humus to the soil by its decay it makes the soil hold moisture better and renders it looser. Barnyard manure adds nitrogen, phosphoric acid and potash to the soil and increases the supply of humus in it, making the soil more retentive of moisture and looser.

Commercial Fertilizers.—As the results from the use of commercial fertilizers vary in different places and in different soils where they are tried, they will be discussed but briefly here. The results from the use of these fertilizers depend so much on the character of the soil and the availability of the plant food in it; on the amount of moisture and the availability of the plant food in the fertilizer itself, that it is necessary for each farmer to experiment for himself in order to find out whether the crops on his soil will be sufficiently benefited by the application of fertilizers to pay

him to use them, as the cost of these is considerable compared with barnyard manure. There are a number of complete potato fertilizers on the market containing the plant food necessary for the potato crop in very available forms. If these are used they may be applied at the rate of from 500 to 800 pounds per acre. A good complete fertilizer for potatoes may be made by mixing 250 pounds nitrate of soda, 350 pounds superphosphate, and 200 pounds sulphate of potash, or muriate of potash, making 800 pounds in all. Even half of this quantity might give satisfactory results on good soil. Slightly better results have been obtained by sowing the fertilizer over the sets when they have been covered with a few inches of soil, and then cover the fertilizer by harrowing than by sowing it in the drill before the sets are planted. If the latter method is adopted the fertilizer should be mixed with the soil before the sets are dropped, as the buds are apt to be injured if the fertilizer comes in direct contact with them. Sulphate of potash has given better results than muriate of potash for potatoes, though both are good.

Fertilizers Recommended for the Potato.—From the information obtained from experiments at the Central Experimental Farm and elsewhere, the writer would recommend growing potatoes after clover which had been top dressed with from ten to twelve tons of barnyard manure per acre. If the clover is ploughed under in the autumn, green manure would be the best; if ploughed under in the spring, which is the better time, rotted manure is preferable, as it will become incorporated with the soil better than green manure and is not so likely to induce scab. The clover may be top dressed with green manure in late summer or autumn, even though the clover is not ploughed under until spring, in which case the manure increases the crop of clover for turning under and is sufficiently broken up and worked into the surface soil to be in good condition for mixing with it when ploughed. Potatoes succeed well after corn which has been given a heavy application of barnyard manure. It is better to manure heavily for the preceding crop than for the potato crop itself.

Preparation of the Land.—The soil for potatoes should be well prepared before planting. Unlike some crops which succeed best when the soil is moderately firm when ready for seeding, the potato succeeds best in soil which is loose. In loose soil the tubers will be smooth and shapely; in soil which is firm or stiff the potatoes are usually misshapen and not nearly so attractive. The ploughing under of barnyard manure and clover makes the soil looser and this added to their value in furnishing plant food makes them particularly desirable. Soils which are very light and loose may be made too loose by the turning under of manure, especially when it is green and strawy, and while it is not the best practice to plough under green manure immediately before planting, especially on light soils, if it is done the soil should be given extra tillage so as to thoroughly incorporate the manure with it and prevent the first few inches of soil from drying out and preventing the satisfactory sprouting of the potato sets.

Spring ploughing for the potato crop is usually best. Where rather stiff soil has to be used, fall ploughing may be preferable as the action of the frost upon it will help to loosen it. Good potato land should be ploughed in the spring, turning under the clover with its top dressing of manure. The soil should be ploughed deep enough so that the clover will be well covered. In order to get the clover well under, a chain is so fastened to the beam of the plough and the whiffle-tree, which holds the clover down so that it may be covered more rapidly. An additional assistance in getting the clover covered is given by using a roller coulter or steel disc in front of the plough. This is usually about 14 inches in diameter and has a sharp edge which cuts the clover plant and prevents much clogging. The time of ploughing in the spring will depend somewhat on the method of planting. If a planter is used there is no necessity of opening furrows, and hence no trouble with clover which has been ploughed under, and the longer the clover is left growing in the spring the better the results are likely to be. If, however, furrows have to be opened, a good plan is to turn under the clover some days before planting time, then disc harrow a couple of times to partially

prepare the land, and later when one is ready to plant, the soil should be thoroughly harrowed with the smoothing harrow and by standing on the harrow or weighting it the upper few inches of soil will be thoroughly pulverized and loosened. It is very important to have the upper layers of soil in fine condition, as if the surface is rough the potato sets or young plants are likely to suffer in a dry time. Different methods of preparation will be necessary for different kinds of soil, but the nearer the land can be got into a thoroughly pulverized condition to a depth of about six inches or more before planting time the better the crop will be. When a planter is used, the soil should be ploughed thoroughly, harrowed, and then rolled just before planting. The advantages of the planter will be stated in the paragraph on planting.

When rotted barnyard manure is used on land without clover it should be applied in the spring and thoroughly mixed with the soil. If it is well rotted it may be harrowed in. Neither rotted nor fresh manure should be put in the drill with the sets, as manure when it comes in contact with the tubers induces scab. This was well proven in experiments at the Central Experimental Farm.

TIME OF PLANTING.

The best time of planting potatoes will vary in the different parts of Canada, much depending on the condition of the ground and spring frosts, but when these have not to be considered the earlier the potatoes are planted the larger the crop is likely to be. The sets should not lie long in the ground before sprouting as there is danger of their rotting, hence they should not be planted when the soil is cold and wet. If they are planted too early also the young vines are liable to get nipped by spring frosts. As early potatoes usually command good prices it is often worth taking the risk of frost and planting early if the soil is in good condition. If the vines should be above ground and there is danger of frost they may be covered slightly with the soil by turning a shallow furrow and covering the plants. Potato growers have saved their vines by doing this. The importance of fairly early planting is brought out in the following experiment conducted at the Central Experimental Farm. In this experiment there is a steady and very marked decrease in the crop at each planting.

Potatoes Planted at Different Dates.—In 1898, an experiment was begun in planting potatoes at different dates, beginning when the main crop was put in and continuing at intervals of two weeks until August 23, 1898; July, 23, 1899; July 21, 1900; July 11, 1901; July 24, 1902; and July 24, 1904. An early and a late variety were used each year, the varieties being Early Norther and Irish Daisy, in 1898; Early Norther and Rural Blush in 1899; Early Norther and Sir Walter Raleigh in 1900; Early St. George and Rural No. 2 in 1901; Everett and Carman No. 1 in 1902, and the same varieties in 1904. The test was not a fair one in 1903, owing to an extreme drought, hence the results obtained that year are omitted. In 1902 two plantings were made before the main crop was put in, the yields from the plantings made on May 15, being the best of the series. The yield per acre from the first planting of an early variety on May 1 was 268 bushels 24 pounds per acre, and from the second planting on May 15, 294 bushels 48 pounds per acre. The yield per acre from the main crop, May 29, was only 217 bushels 48 pounds per acre, so that there was a difference of 77 bushels per acre in favour of the early planting. The results from this one year's test indicate that the best time to plant potatoes is about the middle of May or as soon after that date as possible. The main purpose of this experiment was to find out how late potatoes could be grown and satisfactory crops obtained, and this experiment proves that as far north as Ottawa a fairly good crop of marketable potatoes can be obtained by planting as late as July 10, when they might succeed an early crop, such as garden pease.

Date of Planting.	Total Average Yield per Acre, 1898–1904.		Average Yield per Acre of Marketable Potatoes, 1898–1904.		Average Yield per Acre of Unmarketable Potatoes, 1898–1904.	
Early Varieties.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
1st planting: May 26, 1898, May 26, 1899, May 26, 1900, May 30, 1901, May 29, 1902, May 28, 1904	389	..	337	28	51	31
2nd planting: June 10, 1898, June 9, 1899, June 9, 1900, June 13, 1901, June 12, 1902, June 11, 1904	332	34	269	43	62	51
3rd planting: June 24, 1898, June 23, 1899, June 23, 1900, June 27, 1901, June 26, 1902, June 25, 1904	236	25	187	53	48	32
4th planting: July 8, 1898, July 7, 1899, July 7, 1900, July 11, 1901, July 10, 1902, July 9, 1904	110	9	69	40	40	29
5th planting: July 23, 1898, July 21, 1899, July 21, 1900, July 24, 1902, July 23, 1904	24	25	6	10	18	15
6th planting: Aug. 9, 1898	No potatoes	..	.....		.....	..
7th planting: Aug. 23, 1898	"	..	.....		.....	
Late Varieties.						
Planted on the same dates as early varieties—						
1st planting	368	30	319	9	49	21
2nd "	281	31	227	51	53	40
3rd "	196	42	160	4	36	38
4th "	105	9	57	56	47	13
5th "	37	11	14	58	22	13
6th "	No potatoes		.....		.....	
7th "	"	..	.....		.....	

KIND OF SETS TO PLANT.

The condition the potatoes are in at planting is a very important factor in obtaining a maximum crop of potatoes. If possible, potatoes should be prevented from sprouting, and in the chapter on storing the crop the best methods of keeping potatoes will be discussed. When the set is planted in the field and begins to sprout the young plant gets its food to begin with from the parent set. It also utilizes the moisture in the set and in a dry time it is very important on this account alone to have sets well charged with moisture. When potatoes sprout in a warm, moist cellar, as they so often do, the shoots take from the tubers both plant food and moisture. These shoots are broken off when handling the potatoes, and hence when the tubers are cut for planting they are not in the best condition to produce a good crop of potatoes. Careful experiment and ordinary observation prove that the second shoots which appear are not so strong as the first. In order to be certain that when the sets are cut the eyes will start, a good practice is to spread the potatoes out in the light a few days before cutting them until the eyes start, when they may be cut more intelligently. Experiments conducted by the Department of Agriculture for Ireland in 1904, with main crop or late potatoes, sprouted as described in this bulletin under "Forcing Potatoes for Early Market," showed an increase of 2 tons 13 cwt., or 99 bushels per acre in favour of sprouting the sets before planting. This is a large increase in the general crop.

The commonest and most popular experiments which have been conducted with the potato are those which deal with the kind of sets to plant. Shall they be whole potatoes, one eye, two or three eye pieces; half potatoes, quarter potatoes, stem ends, seed ends, or one of the other many kinds of sets which it is possible to use? These experiments have been going on for the past one hundred years and probably much longer, and the results have been very conflicting in many particulars, but in some respects most of them agree. The experiments prove that all other things being equal the larger the set planted the larger the crop will be, hence large, whole potatoes usually give the largest crop; but as it is the largest crop of marketable potatoes at a

minimum cost that is desired, it has not been found profitable, as a rule, to plant large whole potatoes. The more sprouts there are from a set the larger the proportion of small potatoes is likely to be, as the plant food available during the limited time the potato vine has to grow is not usually sufficient to bring to marketable size enough of the extra tubers produced when the large, whole potatoes are planted. Experiments were begun at the Central Experimental Farm in 1889 and were continued for nine years to get some information with regard to the best kind of sets to plant. It was found that when large, medium and small whole potatoes were compared the crop decreased in proportion to the size of the potato planted. This varied, however, with different varieties. A large potato of one variety with a few eyes might not yield so well as the medium sized potato of another variety which had many eyes. This difference in results also occurred when the potatoes were cut into pieces of a certain weight regardless of the number of eyes, a set of a variety with few eyes might not yield so well as the same sized set of another variety having more eyes. The conclusion reached after many tests is that the most economical kind of set to use is one with about three eyes and a good amount of flesh. When eyes are wide apart a good sized piece of flesh can be obtained with one eye or two eyes, but sometimes eyes do not sprout and many misses in the field have been caused by using sets with only one eye or with too little flesh. There should be a perfect stand of potatoes in the field and the surest way to get this is to plant sets with about three eyes, although often good results are obtained from sets with two eyes, and even one eye, if proper precautions are taken. If the potato vines are frozen after appearing above ground, there will be a much better after-growth from sets having several eyes. As a larger proportion of the sprouts will not have reached the surface. The crop grown from the seed or rose end of a potato will be earlier than that from the stem end, but there will usually be a larger proportion of unmarketable potatoes. Both, however, should be used in planting for the main crop. There is only one thing in favour of sets with few eyes, and that is the fewer eyes to a set, as a rule, the smaller proportion of unmarketable potatoes there will be.

At the Central Experimental Farm the practice is to select good medium to large potatoes, true to type if possible, and make four sets out of the medium sized potatoes, cutting lengthwise and then across. The practice of using small potatoes from which to make the sets year after year is a bad one. It stands to reason that the better developed the potatoes are the stronger will be the shoots from them and the larger the crop. An interesting experiment was conducted by Mr. C. A. Zavitz, Experimentalist, O.A.C., Guelph, Ont. For eight years he planted large, whole potatoes, medium sized potatoes, and small, whole potatoes side by side and each year he used for seed the large potatoes from the crop produced by the large potatoes, the medium sized from the medium, and the small from the small. The average results for eight years were: large, whole potatoes, 199 bushels; medium sized, whole potatoes, 173 bushels; small whole marketable potatoes, 116 bushels; and very small unmarketable potatoes, 99 bushels. These are very convincing results as to the value of using good seed year after year.

Condition of Sets when Planted.—Many farmers cut their potatoes several days or perhaps weeks before planting time, at odd times, it may be, or during inclement weather when they cannot work outside. In another experiment conducted by Mr. Zavitz for eight years it was found that seed planted as soon as it was cut yielded on an average eight bushels per acre more than where they were left unplanted for four or five days. At the Central Experimental Farm, Ottawa, it was found that leaving the sets uncovered in the drills for from one to two days lessened the yields very much. The sets covered at once yielded at the rate of 308 bushels 18 pounds per acre; left uncovered one day, 202 bushels 13 pounds; uncovered two days, 155 bushels 48 pounds. It will be seen that the crop was reduced almost one-half by leaving the sets exposed in the field for two days. The variety being Early Rose. The relative yields will depend much on the condition of the weather. The first day the sets were exposed it was sunny and warm, the second was cloudy and cool. In the same experiments, potatoes which had been cut for one month and left in the root house were compared with

potatoes cut and covered the same day. Those which were cut and covered the same day yielded 308 bushels 18 pounds per acre, those which had been cut one month 165 bushels 45 pounds per acre, a difference of over 142 bushels 33 pounds per acre. This experiment was not continued at Ottawa, hence these are only the results of one year.

It will be seen from the foregoing how important it is to plant fresh seed. Unfortunately, owing to the scarcity of labour, farmers often have to cut their potatoes when they can. If potatoes have to be cut several days before planting it is well to know the best way to keep them. It has been found that by coating the potatoes as soon as cut with land plaster or gypsum, sets will keep better and the yields be increased. Even coating the sets with land plaster when freshly cut and planting immediately has, according to experiments conducted at Guelph, given an increase of 16·4 bushels per acre. The principal reason of this increase probably is that the coating with land plaster prevents evaporation of moisture from the set, thus permitting the young plant to draw more moisture from it. There are several potato cutters on the market, but while some of these are better than others, the most satisfactory way is to cut by hand.

BEST DEPTH TO PLANT.

It is important to know the most economical depth to plant potatoes, as there is no doubt that different depths of planting will give different results, but there will not be the same results on all soils. The yield, however, is not the only point to be taken into consideration, the question of labour being important also. While shallow planting has given the best yields at Ottawa in loose, sandy loam soil the most economical depth is from four to five inches for good loamy soils on account of the harrowing which is necessary to destroy weeds and which would drag out sets which were planted shallower. Sets should be planted deeper in soils likely to dry out than in others more retentive of moisture.

An experiment has been conducted for seven years at the Central Experimental Farm in planting potatoes at different depths in rows 2½ feet apart and 12 inches apart in the rows. The sets had at least three eyes each and were almost uniform in size. The soil was sandy loam every year. Level cultivation was adopted and hence very little soil was thrown on the potatoes after they were covered at planting time. The sets were covered by the hoe, the work being very carefully done. Notes were taken on the depths at which the tubers were formed in 1899, 1900 and 1901, and it was found that most of them were within 4 inches of the surface of the soil even where the sets had been planted six, seven and eight inches deep. Where the sets were planted less than four inches deep nearly all the tubers were found between that and the surface of the soil. This test was begun in 1898 and in the following table the average results are given. The average is for six years only, as in 1903 the severe drought spoiled the experiment that year. The yields in this table represent, as a rule, the average from the yields of two varieties. Each variety was planted in one row 33 feet in length the rows in the experiment being 30 inches apart. The soil was dug out to the proper depth with a spade for greater accuracy.

Experiment in Planting Potatoes at Different Depths in Sandy Loam Soil.

Depth of Planting.	Average Yield per Acre, 6 Years. Bush.	Lbs.
1 inch	466	2
2 inches	380	57
3 "	405	19
4 "	393	59
5 "	387	20
6 "	377	5
7 "	307	20
8 "	284	1

It will be seen from the table that the potatoes planted only one inch deep gave by far the largest average yield. In every year of the six of which the average is given the potatoes planted one inch deep gave the highest yields. This is accounted for in several ways. The first inch or two of soil in spring is decidedly warmer than that below, hence the potatoes sprouted sooner. When the potato sprouted so near the surface, the nodes on the shoots would be nearer together than those lower down and as the tuber bearing stems are produced at the nodes, the more nodes there were the more tubers there would be likely to be. In its wild state the potato bears the tubers near the surface of the ground. While there were a few more potatoes exposed to the sun when they were planted only one inch deep, the increase in yield far more than offset these and in the results which are given these green potatoes were not weighed with the others and are not recorded in the table. The sets were covered about one and a-half inches more by cultivation during the season, so that they were eventually two and a-half inches deep. It must be borne in mind that these results were obtained in loose, sandy loam soil. In stiff soils shallow planting might not have given as good returns. Much of the success of shallow planting will also depend on the moisture in the soil. Shallow planting will not give good results when it is dry at planting time. The only explanation that can be offered for the sets two inches deep, producing less than those three inches deep, is that there would be less moisture two inches deep than at three inches deep, and the warmth of the soil, which would be less at two inches than at one inch, would be more than offset by this less amount of moisture. From three inches in depth the yields decrease regularly.

From the results obtained it would seem clear that where early potatoes are wanted the sets should be planted shallow in the warm soil. Although the best results have been obtained in sandy loam soil which was well supplied with moisture by planting only one inch deep, this method is not recommended for general field culture. Unless the surface of the soil is kept loose and free from weeds, the potato crop will not be large. In order to kill a large proportion of the weeds which grow, the ground should be harrowed once or twice before the potatoes come up or just as they are coming up, and if the sets were only one inch deep they would be dragged out, hence from 4 to 5 inches is the most satisfactory depth to plant.

Distance Apart to Plant.—It is important to know the most economical distance apart to plant the sets, so as to get the largest yields with the least amount of seed. Those varieties which have small tops may be planted a little closer than those kinds which are more vigorous. At the Central Experimental Farm an experiment has been conducted for eight years to determine the most economical distance apart in the rows to plant varieties of average vigour, and in the following table results are given. The table gives the average of seven years only as the very severe drought of 1903 interfered with the experiment that season. In most cases the results are based upon the average of two varieties each year, each grown in one row 33 feet in length.

EXPERIMENTS IN PLANTING POTATOES AT DIFFERENT DISTANCES APART.

Distance apart of sets.	Seed Required per Acre.	Average yield per Acre 7 years.		Average yield per Acre after Deducting Seed.	
	Bushels.	Bush.	Lbs.	Bush.	Lbs.
10 inches apart	35	345	8	310	8
12 "	29	350	16	321	16
14 "	25	353	53	328	53
16 "	22	323	51	301	51
18 "	19	267	48	248	48

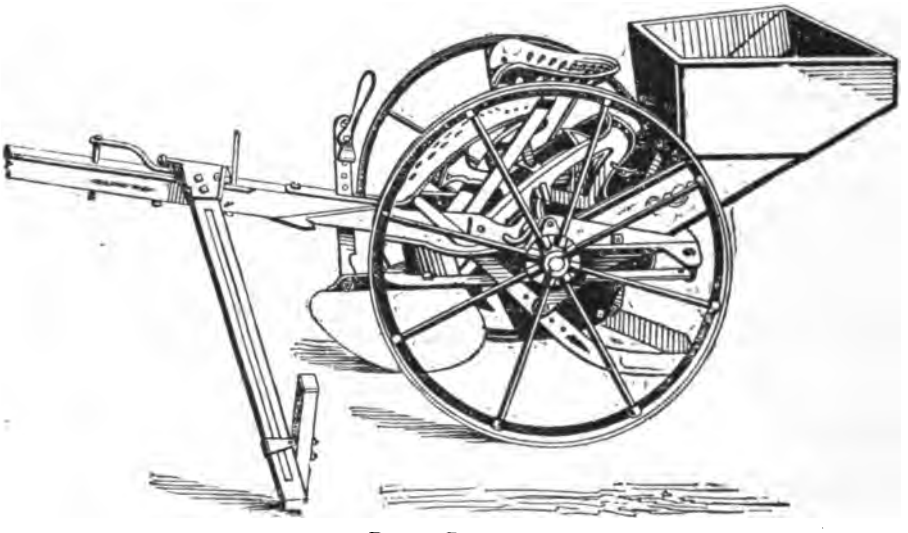
It will be seen from the above table that after deducting the seed used, the net average yield is greatest from the sets planted 14 inches apart. It is, therefore, recom-

mended to plant most varieties of potatoes from 12 to 14 inches apart in the rows. The amount of seed used in this experiment may appear excessive to many farmers who cut to one and two eyes, but at the Central Experimental Farm it has been found best to use sets with a liberal amount of flesh. From our own experience and the experience of others, the best distance between the rows is 30 inches, or just enough to permit of easy cultivation. Where potatoes are ridged it may be advisable to have the rows a little wider apart.

PLANTING AND COVERING.

The best method of bringing the land into good condition having been discussed, also the time to plant, kinds of sets to use, depth and distance apart to plant, it remains before taking up the question of cultivation to say something about the actual planting itself. A common method among farmers is to open the furrows, drop sets by hand and close the furrows with an ordinary plough. This is not the best way. A better plan is to open the furrows with the double mould board plough, making them deep enough, so that when the potatoes are covered and the soil levelled the sets will be from four to five inches below the surface. The furrows may also be covered with this implement. When covered with either of these ploughs the soil should be levelled afterwards with the smoothing harrow. Some good growers use an implement with two concave discs for opening and closing the furrows, as where clover is ploughed under it is sometimes dragged out when the furrows are made with the plough.

The most satisfactory method of planting, however, for one with a fairly large or large area to cover, is with the potato planter, of which there are several good ones now on the market. The planter in the illustration is the Aspinwall planter, mada by the Aspinwall Manufacturing Company, Jackson, Mich.



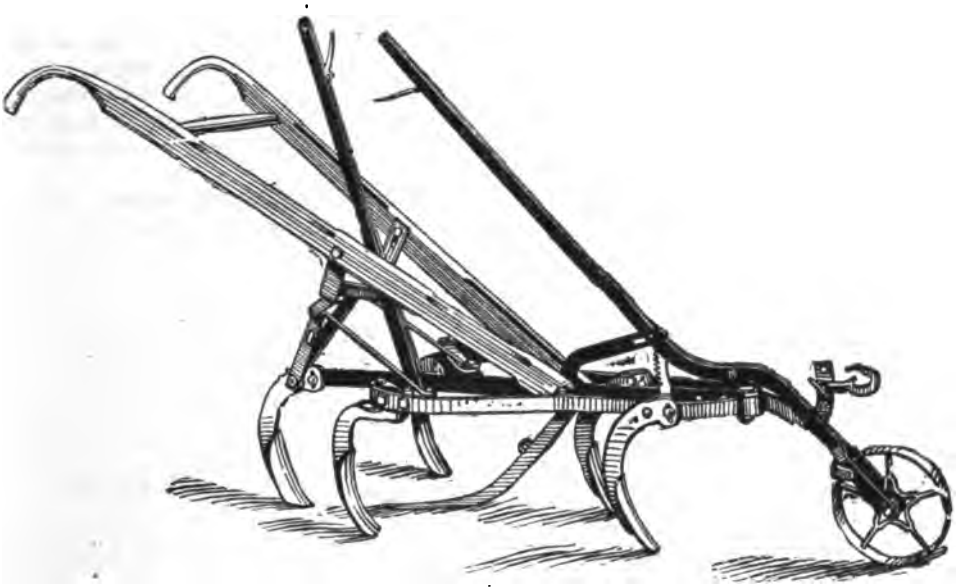
POTATO PLANTER.

The potato planter makes the row, opens the furrows, plants or drops the sets, covers them and applies commercial fertilizers at the same time if desired. To do as much by hand would require a span of horses and a man to open the furrows with a plough, three men or boys to plant, and one man to scatter the fertilizer; and a span of horses and a man with a double mould board plough to cover the sets. There is a great advantage in using the planter as there is no trouble with the clover, and in a dry time the results from planting with a planter are much better than by opening furrows and covering with the plough, as the set, when planting is done with the

planter, is brought closer in contact with the soil and prevented from drying out. In 1903, when there was a very severe drought, the writer heard of a case near Montreal where in a field of potatoes planted with a planter there was practically a perfect stand, while a field of a neighbour just over the fence planted by hand and covered with a plough was practically a failure. If the planter is properly watched there will be few if any misses from sets not being dropped. In a very dry time when there is danger of the sets drying up, it is wise to roll the land before the potatoes are up, loosening it again with the harrow as soon as there is rain.

CULTIVATION.

The success of the potato crop depends in a large measure on the kind of cultivation given. No matter how much the land has been manured and how carefully the sets have been planted, if the soil is allowed to become hard, the weeds permitted to grow apace, and moisture lost, which could be saved, the crop will be very much reduced. A few days after the sets have been covered by the plough and before the plants have been above ground, but not until the weed seeds have germinated, the soil should be harrowed with the smoothing harrow to level it and to kill the myriads of weeds which usually germinate about that season of the year. If possible, the soil should be harrowed twice before the potatoes are far enough up to be injured. If two harrowings are given there should be little trouble from weeds afterwards, and harrowing is a much more economical way of getting rid of them than by hand hoeing. As soon as the potatoes are far enough up so that the rows can be readily distinguished, the cultivator should be put in and the soil loosened between the rows to as great a depth as possible the first time and as near the sets as it is safe to go without disturbing



CULTIVATOR.

them, so as to loosen the soil for the tubers. All future cultivations should be quite shallow to prevent injury to the roots and tubers. The soil should be cultivated every week or ten days, depending on the weather, the object being to keep the surface soil loose until the tops meet well between the rows. If the soil becomes baked evaporation of moisture will be very rapid. From five to six cultivations, or even more, are none too many and it will be found that the crop usually increases in proportion to the number of cultivations. A very careful series of experiments to determine the value of cultivation was carried on by Prof. I. P. Roberts, late director of the Cornell Experi-

ment Station. In one experiment the yield from six cultivations was 344·8 bushels, and from three cultivations 303·3 bushels or a difference of 41·5 bushels. In another case the yield from a plot cultivated six times was 310·5 bushels, and from a plot cultivated three times, 269·6 bushels, or a difference of 40·9 bushels.

Conservation of moisture is very important in growing potatoes and thorough cultivation is one of the best ways to retain moisture. The potatoe vines should not suffer from drought, as they often do in the middle of summer, if the soil were properly prepared to begin with and well cultivated during the early part of the season. The vines must be kept growing thriftily from the time they appear above ground until autumn if a maximum crop is to be obtained. If growth is checked in the middle of summer the crop suffers and the tubers when they start to increase in size when the rains come are very likely to become misshapen. The accompanying cut represents a Planet Junior cultivator. A good cultivator is very essential in growing potatoes.

LEVEL VERSUS RIDGE CULTURE.

The ridging of potatoes is an old method and is the practice usually followed in Great Britain and Europe at the present time and also in America, although level culture has been growing in favour in America during the past fifteen or twenty years. Ridging was probably adopted in the first place for the main purpose of affording good drainage, as in moist climates it is important to not have the potatoes in soil which is very wet. Soil is also warmer when ridged and in cool or moderately cool climates the increase in the warmth of the soil by ridging is favourable to the crop. The condition for the development of shapely tubers is also better in the loose ground which the moulding up of the soil affords. Potatoes are dug much easier in soil which is ridged than where level culture is adopted.

Many farmers owing to lack of help and sometimes through lack of knowledge, give no further attention to their potato crop after the beetles are killed and when haying begins, and as an end to the culture for the season they ridge up just before haying. There is no doubt some advantage in ridging over leaving the soil level when such conditions prevail, as the ridging will give the tubers loose soil to develop in, while the soil would soon get hard if left flat and not cultivated.

There are districts in Canada where the climatic conditions in summer are not very unlike those in Great Britain. In such districts ridging will probably as a rule give better results than level culture. There are, however, large areas where droughts are liable to occur and where conservation of moisture is a very important factor in obtaining a good crop. In such districts the best results will probably, as a rule, be obtained if thorough and deep working of the soil be given and by adopting level culture. The reason is easily apparent. The evaporation of moisture is not as great from level soil as from soil in ridges. Few experiments seem to have been tried for comparing level with ridge culture, but in the drier parts level culture has, as a rule, given the best results. It should be clearly understood, however, that unless the soil is well worked the better conditions of the soil for the development of tubers when it is ridged will offset the advantages of retaining more moisture by level culture. An experiment has been conducted at the Central Experimental Farm for four years for the purpose of comparing level with ridge culture in the soil at the Farm which is an almost ideal soil for potatoes, being a friable sandy loam which does not dry out. In 1900, 1901 and 1902 two varieties were used in this test the Everett and Carman No. 1 in 1900, and Early Sunrise and Carman No. 1 in 1901 and 1902. In 1904 Carman No. 1, Burnaby Mammoth, Maule's Thoroughbred, Reeve's Rose, Prolific Rose, and Canadian Beauty. The average yield per acre of all the varieties under test is given in the results for each year:

LEVEL *vs.* RIDGE CULTURE, SOIL MOIST, FRIABLE, SANDY LOAM.

Method of Culture.	1900.		1901.		1902.		1904.		Average 4 Years.	
	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
Level	543	23	374	7	457	36	419	28	448	38
Ridge	555	37	414	4	518	15	393	48	470	26

Average yield per acre in favour of ridging, 21 bushels 48 pounds.

This experiment resulted in 21 bushels 48 pounds in favour of ridge culture in the moist, sandy loam at Ottawa. There was only one summer out of the four which was dry, and that was in 1901, but that year ridging gave an increase of practically 40 bushels per acre more than level culture. In 1904, the only year when level culture gave the best results, three out of the six varieties gave best results from ridging. Further experiments in this direction are necessary.

It would be advisable for each farmer to try for himself whether level or ridge culture gives the better results under the conditions on his farm.

Mulching Potatoes.—No systematic experiments have been conducted at the Central Experimental Farm in mulching potatoes, but this method has been tried by a number of experimenters, some of whom report favourably and some unfavourably on it. In some cases heavy yields have been recorded by mulching. The condition of the soil has very much to do with success or failure. If potatoes are mulched early in the season the soil may be kept too cold making the conditions bad for the development of a good crop of tubers. To mulch heavily enough to save all cultivation by preventing weeds from growing and conserving moisture, requires too much material and is not profitable. The best and most economical results are obtained by mulching lightly between the rows after the last possible cultivation. This will help very much to conserve moisture in a dry time. Very good yields are sometimes obtained by simply preparing the ground thoroughly, laying the sets on the surface and then mulching with straw. Very shapely tubers of large size are sometimes obtained in this way. In new settlements where the soil is shallow and difficult to work fair crops might be obtained by mulching in this way.

FORCING POTATOES FOR EARLY MARKET.

Where there is a demand for early potatoes it is important for the potato grower to know how he can hasten the development of the tubers, as the sooner the potatoes are on the market in good condition the more money he will make out of them as a rule. The method usually adopted by the best growers is to use an extra early variety and 'sprout' the potatoes before planting. Medium-sized tubers are selected before they have begun to sprout and placed in single layers in shallow boxes or trays with the seed end up. The boxes are then put in a bright, airy, cool place, where the temperature is low enough to prevent sprouting. After a few days the potatoes will turn green and the skin becomes much tougher than before the potatoes were exposed. The potatoes are now given a little more heat, but still kept in a bright, airy place. From the seed end will now develop two or three strong sprouts and the meaning of exposing the potatoes at first to toughen the skin is now apparent, for most of the eyes do not start and practically the whole strength of the potato is concentrated in a few sprouts at the end. This is what is desired, as the fewer sprouts there are the larger proportion of marketable potatoes there will be. If the potatoes are given plenty of light and the place where they are kept, fairly cool, the sprouts will become very sturdy and strongly attached to the tuber and will not be broken off in handling unless very carelessly used. Tubers will develop more quickly from sprouts made slowly in a bright, cool place than from sprouts which have grown rapidly in a dark place, and

furthermore, the yields will be much heavier. Potatoes which sprout in the dark are, moreover, very difficult to handle as the sprouts break off very easily. It is not absolutely necessary to place the potatoes with the seed ends up as very satisfactory results are obtained when potatoes are emptied indiscriminately into shallow boxes or trays and then treated as already described. The sprouts should be about two inches in length at time of planting. If longer the sets are more difficult to handle.

The warmest and best drained soil that can be obtained should be used for extra early potatoes and the sets should be planted shallow so that they will get the advantage of the heat from the surface soil. The potatoes are planted whole as they do not rot as readily as cut pieces, and the sprouts also have more to draw on. The sprouts are of course left uppermost when the potato is planted. As most extra early varieties have small tops the sets may, as a rule, be planted a little closer than for the main crop.

By planting the potatoes whole quite a large quantity of seed per acre is used, some growers using as much as 40 bushels, but this is much more than offset by the early and increased crop. The potatoes are planted just as soon as the soil is dry enough to work, and there is no danger of very severe frost, but as considerable risk has to be taken from frost everything possible should be done to prevent the young plants from being frozen. A very good plan, if there is danger of frost, is to plough a light furrow turning a little soil over the plants which as a rule will be sufficient to protect them. This may be removed afterwards with the harrow or in some other way. Moderate ridging is, as a rule, better than level cultivation in growing extra early potatoes in Ontario and Quebec, as the soil is rendered warmer and the development of the tubers hastened.

Rate of Development of Tubers, showing importance of keeping Potato Tops Green.—No more striking proof is afforded of the importance of keeping the potato tops green and the plants growing thriftily well into the month of September than the results obtained by Prof. L. R. Jones, of the Vermont Agricultural Experiment Station, by digging potatoes at different dates and estimating the yield per acre. This experiment is recorded in Bulletin No. 72 of the Vermont Station. It is a simple experiment and one which every farmer should try for himself. Following is the table showing the results obtained:—

YIELD OF TUBERS AT DIFFERENT DATES—WHITE STAR POTATOES, PLANTED MAY 20.

Date of Digging.	Total Yield per Acre.	Yield of Marketable Size.	Average Size of Tubers.
	Bushels.	Bushels.	Ounces.
August 2	58	30	1·6
12	115	75	2
22	230	163	3·7
September 1	304	234	4·4
12	356	303	5·2
22	379	353	5·7

It will be seen that 1·29 bushels per acre of marketable potatoes developed during the month of September. In the province of Ontario many fields of potatoes are dry and brown by September, either through lack of cultivation or from disease. Not only is the yield of potatoes much increased by keeping the vines green well into September, but the quality of the potatoes is much improved also. When potatoes are killed early in the season, many of the tubers are immature. In a previous chapter we have tried to show the importance of good cultivation in maintaining a vigorous growth through the early part of the season, in the following chapter on Insects and Diseases it will be shown how the tops may be kept green through the latter part of the season.

INSECTS AND FUNGOUS DISEASES

In some parts of Canada injurious insects and fungous diseases of the potato are practically unknown, but in the provinces of Ontario and Quebec both are very destructive. The leaves of the potato vine must be kept intact and in a thrifty condition if a maximum crop is to be obtained, and both insects and diseases should and can be fought and conquered if the well-known and thoroughly tested preventatives and remedies are used. It is not necessary in a bulletin of this kind to mention all the injurious insects and fungous diseases to which the potato is subject, but the important ones are herewith discussed.

Colorado Potato Beetle (*Doryphora decemlineata*, Say.).—This is such a well-known insect that it need scarcely be described. It may be well, however, to give its life history for the benefit of those who do not know it. The mature beetle hibernates in winter and begins to fly early in the spring. As soon as the first leaves of the potato appear above ground, the beetles fly to them and soon lay their yellow eggs in clusters on the under side of the leaves. In about a week the young beetles or larvæ appear and begin to devour the foliage with a rapidity which is only too well known. The last brood of larvæ, which disappear into the soil before severe frost, pupate there, remaining in the ground in the form of perfect insects until the following spring. Fortunately there are good remedies for this insect in Paris green and other insecticides. The importance of preserving the foliage as nearly intact as possible has already been impressed on our readers. It is well known that the loss in a crop where the vines have been allowed to be devoured by potato beetles is enormous, sometimes the crop being scarcely worth digging. The longer the spraying is delayed, the greater loss there will be. If cheap help can be obtained it will be advisable to spray the vines when they are quite small, or pick off the old beetles before they have deposited their eggs, but if help is scarce it may not be possible to do this, and the temptation to leave the old 'bugs' alone is great, as they do little injury to the foliage. Unfortunately on perhaps the majority of farms, nothing is done to destroy the potato beetles until the foliage is noticed partly eaten. This is too late. By the time the Paris green takes effect the vines are badly injured and the future crop much lessened. Potato growers should not wait until the vines are injured, but should be on the look out for the young 'bugs,' and as soon as they appear an application of some good insecticide should be made. As the eggs are not all laid at the same time, the larvæ do not hatch all at the same time, and it is usually necessary to spray several times before they are all killed. As it is important to kill the beetles as soon as possible an insecticide which will act quickly is desirable and also one that will adhere to the foliage. The cheapest and best insecticide is Paris green, which should be applied in the proportion of 8 ozs. Paris green to 40 gallons of water with about 4 ozs. of lime to neutralize the effect of free arsenic on the foliage. Four ounces of Paris green to 40 gallons of water will kill the insects, but does not act as quickly as eight ounces. If applied dry, a good proportion is 1 lb. Paris green to 50 lbs. slaked lime, land plaster or any perfectly dry powder. The dry mixture should be applied when the vines are wet, so that it will adhere better. There are strong advocates for both the wet and the dry mixtures. Wet mixtures may be put on at any time when the weather is fine, but if best results are to be obtained dry mixtures should be applied only when the dew is on the foliage. If the dry mixture is put on when the foliage is moist it will adhere better than the wet mixture and will also be more evenly distributed. Bug Death, dry and also in the proportion of 1 lb. to 2 gallons of water, has been found a good insecticide, but is more expensive than Paris green. Arsenate of lead also gives good results, but as a rule is not as economical to use as Paris green.

The Cucumber Flea-beetle (*Epitrix cucumeris*, Harr.).—This little insect frequently does much harm to the potato crop, and being so small, is often not seen, but the result of its depredations will be found in the many small holes which may be noticed in the leaves and in the lessening of the crop on this account.

In his report for 1901, Dr. James Fletcher, Entomologist and Botanist of the Dominion Experimental Farms, writes the following regarding this insect:—

'This minute beetle, which does not exceed one-twentieth of an inch in length, is black, covered with short fuscous hairs, and is much more frequently complained of as a potato pest than as an enemy to any other crop. It is sometimes in the hot dry summers, one of the worst enemies of the potato, eating many small holes through the leaves and reducing them so much that they are unable to perform their functions. Reports of injury have been received from Vancouver Island and several places in Ontario. The best remedy for this insect appears to be spraying the vines with Bordeaux mixture and Paris green. This treatment has given far better results than spraying with Paris green alone. The practice, too, of spraying potatoes with Bordeaux mixture is also an excellent one being an effective preventive of the Early Blight, as well as the much more destructive Potato Rot or Late Blight.'

It is found that the parts of the leaves which are injured by the Flea Beetle make suitable lodging places and points for germination of the spores of the Early and possibly the Late Blight. We believe, as recommended in the above quotation, that keeping the vines covered with Bordeaux mixture and Paris green is the best preventive in this case.

The Early Blight or Leaf Spot Disease (*Alternaria Solani* (E. & M.) Jones & Grant). This disease was known until recent years by the name of *Macrosporium Solani*, E. & M., but through the investigations of Prof. L. R. Jones, Botanist of the Vermont Experiment Station, the name has been changed to *Alternaria Solani*. The Early Blight is not nearly as destructive as the Late Blight, and does not cause the rotting of the potatoes. It is most destructive in dry seasons or in neglected fields where the plants are not making thrifty growth, developing much more rapidly on foliage which is not vigorous than on that which is healthy. Fields of potatoes which appear to have ripened prematurely or very early are frequently brought into this condition by the Early Blight. It usually begins to appear early in July and is sometimes taken for the Late Blight. This disease apears in spots, having concentric rings irregularly over the leaf, quite in contrast with the Late Blight which is usually observed first in large patches on the leaf. The spots of the Early Blight gradually enlarge and unite when several spots will form quite a large area. When these spots extend to the margin of the leaf it causes the edge to curl up, giving it somewhat the same appearance as Tip Burn or Scald, and finally the whole leaf may wither and dry up, followed by the death of the potato plant. While this disease is called the Early Blight, it occurs late in the season as well as early and may be found in an active condition during the month of September.

This disease spreads by means of spores, which alight on the leaves, germinate and penetrate the epidermis and breathing pores. The disease then permeates the tissues of the plant and new spores are again borne in a short time. The disease is carried over winter in the dead potato stalks.

Prevention and Remedy.—The treatment of this disease is preventive rather than remedial. The vines should be kept covered with Bordeaux mixture from the middle of July until the end of the season. It is a good plan to burn the stems after digging.

Late Blight or Rot (*Phytophthora infestans*, D. By.).—Although much of the premature killing of potato vines, is due to the Early Blight, which is frequently mistaken for the Late Blight, the latter is by far the most serious disease, as it spreads with much greater rapidity and in addition to the killing of the tops causes the rotting of the tubers. The life history of this disease was described in 1846, and little more is now known regarding it than at that time.

The disease passes the winter in the tubers and is taken to the field in them and is planted with the sets. When the vines begin to grow it starts to develop also and grows up through the tissues of the potato stems. During the latter part of July or early in August it produces on the under sides of the leaves myriads of tiny spores which in the mass have a frost-like appearance. These spores make the 'rust' stage which is caused by the leaf tissues drying up where the spores have been feeding on them, leaving dark brown spots. It is at this stage that future infection takes place, as the spores being carried rapidly by wind alight on the foliage, germinate, develop and in a very short time destroy the leaves. The disease spreads with such rapidity that in a few days the

Photo. by Frank T. Shutt.

SPRAYED POTATOES. UNSPRAYED POTATOES.

CENTRAL EXPERIMENTAL FARM, OTTAWA, 28TH SEPTEMBER, 1904.

[p. 32]

tops in the whole field are destroyed. Infection of the tubers is supposed to take place in two ways. In the first place by the disease spreading through the plant and by means of the underground stems reaching the tubers; and secondly by the spores being washed below the surface of the ground and reaching the tubers, infecting them, and if the conditions are favourable for the development of the disease causing them to rot. This latter means of infection seems to be conclusively proven by some experiments carried on in Denmark by J. L. Jensen, Director of Bureau Ceres in Copenhagen. The results of his experiments were published in 1882 in a little book called 'How to Overcome the Potato Disease by a Simple and Easily Performed Method of Cultivation.' As this book was published before Bordeaux mixture was discovered as a preventive of blight, it is very interesting and suggestive. The following quotation from this book gives in a few words the results of eight experiments which were conducted by ridging up the potatoes and comparing those thus treated with those grown under flat cultivation. The ridges were made high and sharp at the top to shed rain and prevent spores being washed down to the tubers.

'In estimating the value of the present most important experimental results it must be borne in mind that the potatoes at all the experimental stations were grown side by side without any difference whatever in the conditions under which they were grown than the moulding alone. Consequently the disease has, by perfect protective moulding, on an average been diminished from 23.4 or 18.7 per cent to 1.4 per cent, or verbally expressed, from a very considerable magnitude to what may, practically taken, be called a mere trace of disease. Expressed in entire numbers, the average disease for the different methods of moulding from flat to perfectly protective (high and sharp ridges) stands as 17 : 13 : 3 : 1.'

While this high protective moulding which consisted in high ridges sharp at the top and with the tops of the vines bent over, appears to have prevented the spores reaching the tubers, it had of course no effect in preventing the tops from being destroyed by it.

The disease usually appears in Ontario and Quebec between the middle of July and the first of August, though sometimes later. The strong and disagreeable odour from a potato field where the Late Blight is at work is familiar to all, and although it is too late to get the best results after the disease has begun to spread rapidly, it may sometimes be checked by thorough spraying at that time. The loss from Blight is usually greatest from the main crop and late varieties, as the early potatoes are usually well advanced before the conditions are the most favourable for the rapid development of the disease. The weather, which appears to favour the spread of the Late Blight, is what is usually known as 'muggy,' or close, warm days with much moisture in the air. With these conditions myriads of spores germinate, and the disease spreads through the tissues of the leaves and destroys them with great rapidity.

Prevention of Late Blight.—It is now about twenty years since Bordeaux mixture was first used for the prevention of Late Blight, the first known application of it having been made in France in 1885. From the very first it gave good results and has been steadily growing in favour ever since, but only a small proportion of Canadian farmers even at this date spray their potatoes for the prevention of Blight. In America the first systematic and continuous experiments with the Bordeaux mixture were those begun at the Vermont Agricultural Experiment Station by Prof. L. R. Jones. He began experimenting in 1889, and for fifteen consecutive years has continued demonstrating the practical value of Bordeaux mixture as a preventative of Late Blight and Rot. In his report for 1903 he gives the average results of thirteen years' experiments. The yield of potatoes where sprayed averaged 286 bushels; where unsprayed, 171 bushels, or an average difference in favour of spraying of 115 bushels per acre. This should be sufficient evidence for every farmer that even if some years the Blight does not do much injury, yet it pays many times over to spray every year.

At the Central Experimental Farm, Ottawa, this disease has received much attention, because of the importance of the potato crop in Canada and the great loss there

is every year from Blight and Rot. In his report for 1892, Dr. James Fletcher, Entomologist and Botanist, described the life history of the Late Blight and recommended the use of Bordeaux mixture as a preventative of the same. Circulars were also sent the same year to the leading newspapers. In 1894, Dr. Fletcher published a bulletin on Potato Blights, in which further information was given and from that time a continuous effort has been made to get farmers to spray their potatoes for this destructive disease. Experiments were begun in 1892 at the Central Experimental Farm and at Nappan, N.S., with gratifying results. During the past few years the Blight has been worse than usual and the effect of spraying has been more marked. In the following table will be found the average results obtained at the Central Experimntal Farm for the years 1901, 1902 and 1904. In 1903 the stand of plants was uneven owing to a protracted drought in spring and the results were made of no value. As we have already stated, some varieties of potatoes appear to be much less subject to blight than others.

—	1901. Average Yield per Acre of Marketable Potatoes. Sprayed four times: and Unsprayed.		1902. Average Yield per Acre of Marketable Potatoes. Sprayed four times, and Unsprayed.		1904. Average Yield per Acre of Marketable Potatoes. Sprayed five times, and Unsprayed.		Average Yield per Acre of Marketable Potatoes. Three years Sprayed and Unsprayed.	
	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
Sprayed	333	43	310	12	369	21	337	45
Unsprayed	233	11	189	54	306	39	243	15
Average Increase in Yield per acre of Marketable Potatoes from Spraying	100	32	120	18	62	42	94	30

The cost of spraying potatoes with Bordeaux mixture is not large compared with the great increase in yield from the use of it. Following are approximately the items of expense:—

Cost of Spraying with Bordeaux Mixture for the Prevention of Blight per Acre—Four Applications.

Bluestone, 72 lbs. at 6 cents	$4 32
Spraying four times, horse and two men—8 hours at 30 cents.	2 40
Total	$6 72

This expense will be less on large areas and with the best appliances for making and using the mixtures. From four to six dollars being the probable cost.

As it would be sometimes necessary to spray with Paris green about the time of the first application of Bordeaux mixture, these could be put on together, hence the expense of one spraying with Paris green, 60 cents, may be deducted, leaving $5.52 as the extra cost in applying Bordeaux mixture. The average increase from spraying three years has been shown to be 94½ bushels. At 40 cents a bushel, this is $37.80, or after deducting $5.52, a net profit of $32.28 per acre. As a good spray pump can be obtained for less than this amount, the price of a pump would be more than saved on one acre in one season. It has been found that one spraying only, if applied just when the disease begins to spread, has been found to give very satisfactory results, and the more the disease is studied the safer it will be to reduce the number of applications to two or three, but for the ordinary farmer it is wise to begin spraying about the middle of July, and keep the vines covered until September, and it will usually take at least four applications to accomplish this. Other preventatives have been tried, but none have given as satisfactory results as Bordeaux mixture made as described under the formulas for spraying. The illustration showing sprayed and unsprayed potatoes de-

monstrates the advantage of spraying to protect the foliage from blight. The vines on the unsprayed plot were dead eighteen days before those on the sprayed.

Experiments with Bug Death, which have been reported on in the annual reports of the Central Experimental Farm for 1902 and 1904, have not given nearly as satisfactory results as Bordeaux mixture. Bug Death and Bordeaux mixture together did, however, give better results in 1904, than Bordeaux mixture alone. This combination has only been tried one season, hence no definite conclusions can be drawn.

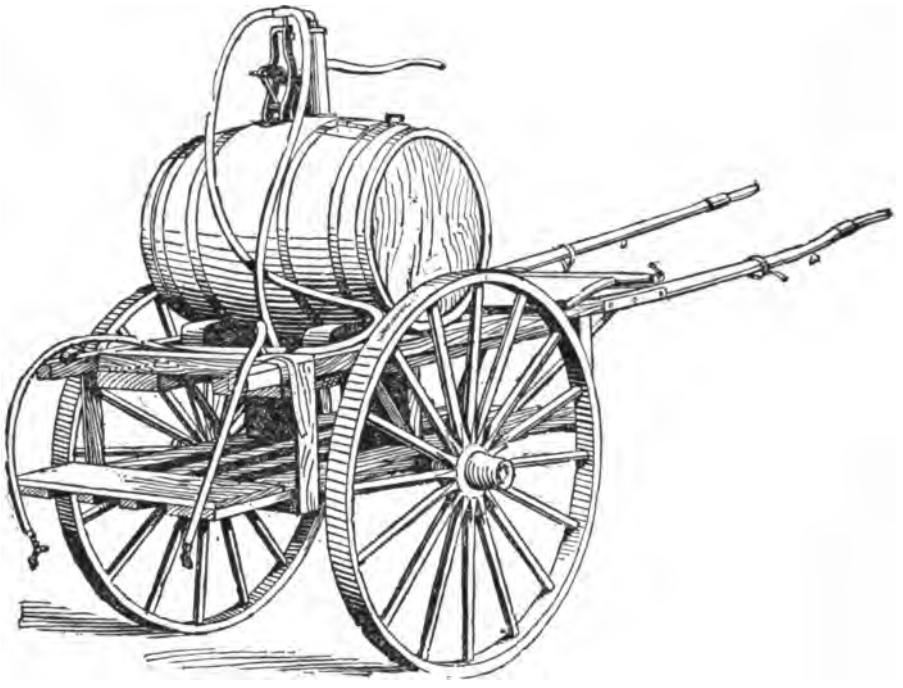
TIP BURN.—This is a drying up of the tips and margins of leaves, and is due to a loss of vigour in the plant either on account of hot, dry weather or neglect in cultivation. Leaves injured by Tip Burn are often affected with the Early Blight disease also. Thorough cultivation will prevent Tip Burn to a large extent.

POTATO SCAB (*Oospora Scabies*, Thaxter).—In some parts of Canada and under certain conditions of soil and treatment of it, the potato scab has been very troublesome, preventing the proper development of the tubers and making them unattractive, and hence less saleable. Many persons believe that the scab is caused by insects in the soil and by other agencies than the true one, but the life history of the scab has been studied and it has been proven to be a parasitic fungus. It is usually most troublesome in alkaline soils and land which has been heavily dressed with fresh barnyard manure is especially favourable to the spread of this disease, especially when the manure is put in the furrows and comes in close contact with the tubers. Lime and ashes also have the effect of increasing the amount of scab. The spores of the scab fungus develop in the field on the affected parts of the potato and are thus taken to the roothouse when the potatoes are dug. There is no doubt that many potatoes not diseased in the field are infected in the roothouse or on the way to it by some of the myriads of spores from the diseased potatoes falling on them. It is believed that the scab spores will be in the ground for from six to seven years and will re-infect a crop after that time. This shows the importance of avoiding fields which have produced scabby potatoes as long as possible. The spores on potatoes intended for seed can be destroyed by two known remedies which appear equally good, the first being a solution of formalin (Formaldehyde), 8 ozs., or ½ pint in 15 gallons of water. The potatoes should be soaked in this for two hours. The second remedy is a solution of Corrosive Sublimate, in the proportion of 1 ounce to 7 gallons of water, the tubers being soaked for 1½ hours. When the tubers are dry they may be cut for planting. The same solution may be used several times. This treatment will assure the planting of seed free from spores, but if the spores are already in the field they may re-infect the tubers. As the scab of potatoes appears to be the same as affects some of the field roots, it will be well to avoid planting potatoes after a crop of scabby roots. The potatoes freest from scab are usually found after clover sod or in acid soils. Such fertilizers as muriate of potash, sulphate of potash, and nitrate of soda appear to check the disease. Land plaster and common salt are also useful. Some varieties of potatoes are less subject to scab than others.

METHODS OF APPLYING SPRAY MIXTURES.

A good spray pump is considered an absolute necessity with every progressive fruit grower, but there are few farmers who yet own one. It has been proven by experiments at the Central Experimental Farm that more than the price of a good spray pump can be saved in one year on one acre by spraying potatoes with Bordeaux mixture to prevent blight and rot, but a spray pump is useful for other purposes than applying liquid mixtures to the potato crop. Most farmers in the provinces of Ontario and Quebec have some fruit trees or bushes which need spraying, and a spray pump is very useful and necessary in treating them. A pump may also be used to whitewash or paint barns, outbuildings and fences, it having been found that one of the most economical methods is to use a spray pump. It may be used for disinfecting stables, cleaning vehicles and washing windows. No farmer and no potato grower should be without a good spray pump. Good pumps suitable for most purposes cost from about

$25 upwards; cheaper ones may be obtained, but are not as satisfactory, and it is much more economical to get a good one to begin with. One great advantage that a good pump has over a poor one is that the operator can develop more power with it. The accompanying cut represents a Spramotor pump mounted on a special cart for spraying purposes:—



SPRAY PUMP MOUNTED ON A CART.

Spraying is not sprinkling. A spray should be applied in the form of a fine fog-like mist and this only can be obtained with a good pump and a good nozzle, the latter being almost as important as the former. When spraying, the object is not to put on so much liquid that it will run down the leaves, but just enough to cover the leaves evenly and well, as the insecticide or fungicide must be evenly distributed over the leaf so that every part will be protected if the best results are to be obtained. A fine spray will envelop the leaf, protecting the underside as well, which is important. If the spray is coarse and much of it is applied the liquid will run down the leaf carrying with it the fungicide or poison and this accumulating at the tips of the leaves often causes burning and injury to them. It is also very wasteful to apply the liquid in a coarse spray.

Potato spraying attachments are now made for most good sprayers and from four to six rows can be sprayed at one time. The latest devices have the nozzles arranged so that the vines may be sprayed from beneath as well as above, which is important, as all parts of the plant above ground should be protected. With these attachments one man and a horse can get over a large area in a day. This is not always the most economical way to do, as for instance, if a nozzle or nozzles should become clogged the machine may go for some distance before this is noticed and there will be a patch left unprotected where the potato beetles can work and the potato blight may get a strong foothold, or perhaps the cart will jolt. Thoroughness is very essential, both in spraying for the potato beetle and for blight. A wise plan, if a four or six attachment is used, is to have a man or boy on the back of the sprayer watching for any clogging of the nozzles. The method preferred by the writer, though a little slower than that mentioned, is to spray two rows at one time, a man or a boy driving and one sitting at the back holding a hose and nozzle in each hand. By this method one

can direct the spray better and can immediately note and fix a nozzle if it should become clogged. In this way the work is more certain to be thoroughly done and thoroughness, especially when disease or insects are very troublesome, is better than speed. The distance apart of the rows should be regulated at time of planting, so that the horse and wheels of the cart will come between the rows. Many home-made machines for spraying are used, but most of these are very wasteful of material and the liquid is put on in so coarse a spray that it runs down the leaf and most of the poison is washed off or down to the tip. There is no doubt that much of the difficulty in killing Colorado Potato Beetle is due to the fact that the poison is not evenly and thoroughly distributed over the leaves. There is the same defect with the watering can, which is an article which has been used in spraying potatoes for many years. There is no doubt that the reason why the dry application of Paris green for the prevention of the Colorado Potato Beetle is preferred in many places to the liquid is that when applied dry the poison is more evenly distributed. Various shakers and blowers have been invented for applying poison dry.

The effectiveness of an application of an insecticide or fungicide will be in proportion to the thoroughness with which the mixture is applied. Every part of the leaf left unprotected may mean a foothold for insects or disease.

FORMULAS RECOMMENDED.

Bordeaux Mixture.—For potato blight and rot, and for flea beetles:

Copper sulphate (bluestone)	6 pounds.
Unslaked lime	4 "
Water, (1 barrel)	40 gallons.

Dissolve the copper sulphate (by suspending it in a wooden or earthen vessel containing four or five or more gallons of water.) Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place; half fill the barrel with water, add the slaked lime, fill the barrel with water and stir thoroughly. It is then ready for use. It is important to not mix the lime water and the sulphate of copper solution before diluting.

A stock solution of copper sulphate and lime wash may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of copper sulphate, lime and water should be carefully noted.

For Colorado Potato Beetle.—Add 8 ounces of Paris green to the above formula.

Formalin, Corrosive Sublimate.—For Potato Scab.

Soak the tubers either:—

1. For two hours in a solution of commercial Formalin (Formaldhyde) 8 oz., in water 15 gallons, or

2. For one and a half hours in a solution of Corrosive Sublimate 1 oz., in water 7 gallons. When dry cut up for planting.

Formalin has the advantage of being neither poisonous nor corrosive, while Corrosive Sublimate is a fatal poison if taken internally. It also corrodes metals. The solution should, therefore, be made in wooden or glazed vessels. All treated seed should be planted, and any solution left over should be poured into a hole in the ground.

Paris Green.—For Colorado Potato Beetle:

Paris green	8 oz.
Unslaked lime	4 oz.
Water	40 gallons.

A less quantity of Paris green, say 4 ounces to 40 gallons of water is sufficient if the insects have just hatched. Make a paste of the Paris green before diluting by mixing a little water with it. It will not settle as quickly in the barrel if this is done.

Dry Mixture.—1 pound Paris green with 50 pounds flour, land plaster, slaked lime or any other perfectly dry powder.

Soda Bordeaux (Burgundy mixture).—For Potato Blight and Rot:—

Copper sulphate (bluestone)	6 lbs.
Washing soda (carbonate of soda)	7½ lbs.
Water (1 barrel)	40 gallons.

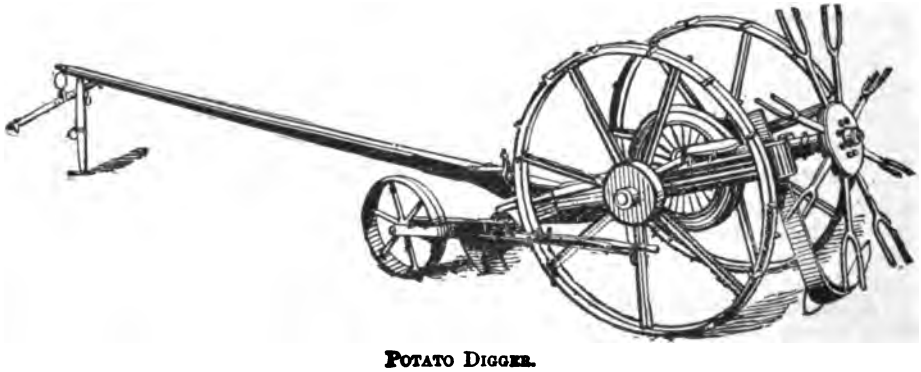
Dissolve copper sulphate as for Bordeaux mixture. Dissolve 7½ lbs. washing soda in four gallons of water. Pour the copper sulphate solution into a barrel; half fill the barrel with water, then stir in the solution of washing soda, and finally fill the barrel with water. It is now ready for use. The Soda Bordeaux adheres better to the foliage when freshly made than ordinary Bordeaux mixture, but it deteriorates rapidly in this respect and must be used as soon as made. If left to stand for twenty-four hours it will have lost nearly all its adhesiveness. The Soda Bordeaux is not recommended in preference to the ordinary Bordeaux mixture, but where lime cannot be obtained it may be used with good results. Furthermore, on account of its freedom from gritty matter there is less likelihood of the nozzle becoming clogged when it is used. As washing soda is considerably more expensive than lime this mixture costs more than the ordinary Bordeaux mixture.

Other Insecticides and Fungicides.—There are a number of insecticides and fungicides now offered for sale under various names, but none of these which have been tested at the Central Experimental Farm have been found as satisfactory to use as those we have recommended, although some of them have proven effective.

Importance of having Good Materials and Preparing the Mixtures Properly.—The importance of having good materials cannot be too strongly impressed upon potato growers. Great losses may occur from having an insecticide or fungicide of poor quality. The mixtures should be carefully prepared. Unless a mixture or solution is made properly and applied at the right time it may have little or no effect and the time and materials are lost. There may also be injury to the vines.

DIGGING POTATOES.

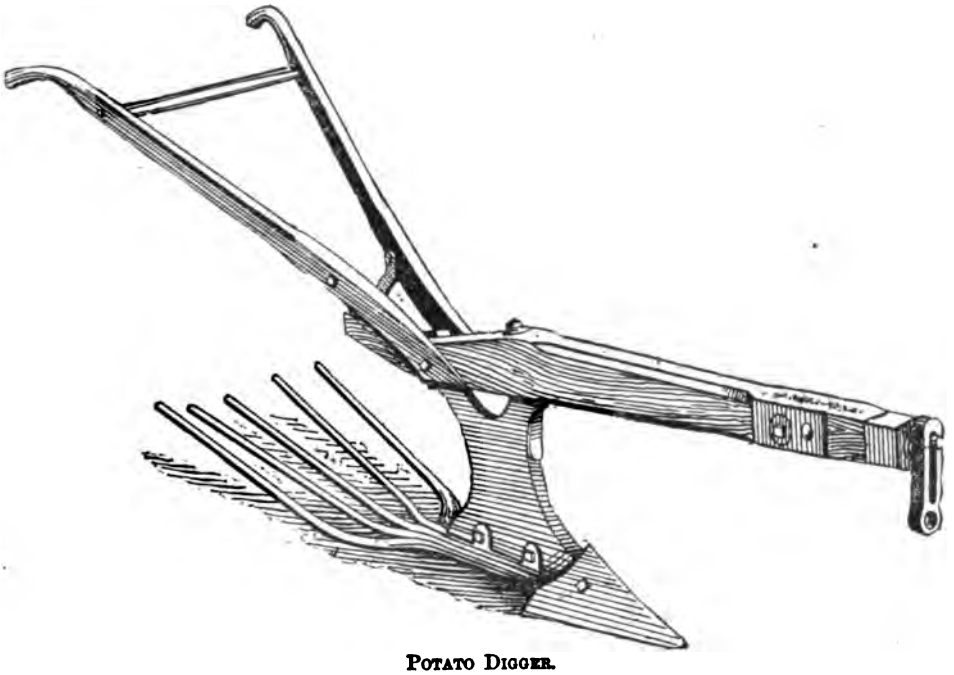
If potatoes have not been affected with Late Blight or Rot the best time to dig them is as soon as the tops have died, if the weather is favourable. Potatoes are usually dug just after the corn is harvested or before the frost becomes severe enough to freeze the soil to the depth of an inch or so. This time of digging is usually chosen as a matter of convenience and quite irrespective of when the stalks die, as the latter dry up in many places about September 1, and often before, and the potatoes are frequently not dug until about a month afterwards. When the soil is well drained and not wet there is not much danger to the crop by leaving it in the ground for this length of time, but if there is no disease the sooner they are dug the better.



POTATO DIGGER.

Potatoes which have been killed by Late Blight will usually rot as soon as the conditions are favourable, and for this reason a diseased crop is better left in the ground as the tubers which are diseased will most of them show signs of rot before they have to be taken up on account of frost and they need not be picked up at all. If diseased potatoes are dug and stored as soon as the tops are dead, the disease will be almost certain to develop in the pit or cellar and healthy tubers will rot from contact with the diseased ones. It is not good practice to dig diseased potatoes early and pile them in the field. It is better to delay digging as long as possible and then put the potatoes in a cool, well ventilated cellar where the disease may be checked. Potatoes in wet soil should be dug sooner than those in that which is drier and well drained. Every healthy potato will eventually rot in wet soil from 'wet rot,' even though they were not affected with the Late Blight.

Potatoes should be dug in dry weather so that when they are taken to the cellar or store-room they will be perfectly dry. If the tubers are housed when wet the conditions become very favourable for the development of the disease which may affect them and for the rotting of the healthy potatoes from contact with those thus affected.



POTATO DIGGER.

Where there are large areas to be dug a good potato digger is essential. Not only will a potato digger raise the crop more economically than by a fork or plough but with it the grower is more likely to get his crop dug and picked up while the weather is fine, which is a great consideration. There are a number of good potato diggers now on the market which will dig up and leave on the surface of the soil practically all the tubers.

The first cut is the Ellard digger, manufactured by W. J. Ellard, Ottawa, Ont. The digger with the fork-like attachment was made at the Central Experimental Farm.

Next to a good potato digger a fork-like attachment to a plough does the best work. That in the illustration is one used at the Central Experimental Farm with very fair success. The fork is attached to the side of the plough and not to the point, in which it differs from some others. Being attached to the side, it prevents much clogging from the potato tops as the rows can be ploughed from the side. There are some potatoes left in the ground even when this attachment is used, but not nearly as many as with the plough. Ploughing potatoes out has become quite a common method

among farmers since help began to get scarce and it was difficult to get men to dig, but in ploughing them out there is always a large number of potatoes left on the ground and the additional labour required to pick up these potatoes which are scattered all over the field is considerable.

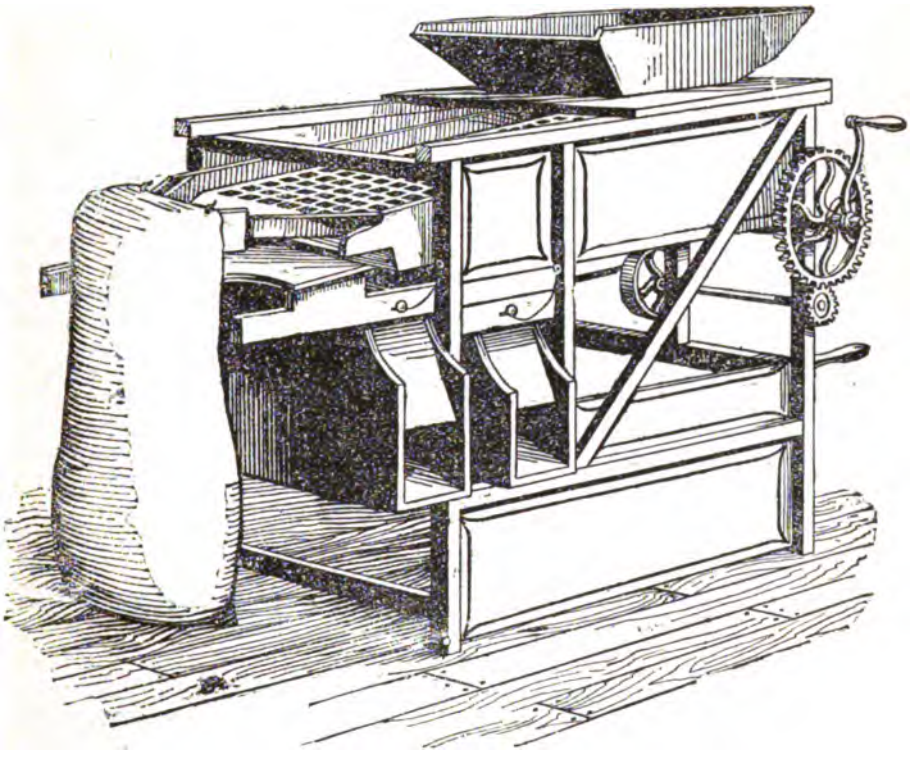
The old fashioned yet thorough way of digging with the four tined potato fork is too slow and expensive a method now that good men are difficult to get and wages are so high, but where these do not have to be taken into consideration as good or better work is done by a man than by any implement. A man with a fork will dig little more than half an acre a day. A good potato digger will dig from three to five acres a day.

Storing.—Potatoes should be stored dry in a cool, well ventilated cellar which is perfectly dark. There is no doubt that great losses occur every year from the careless storing of potatoes which are put in wet in comparatively warm and poorly ventilated cellars and piled in great heaps, giving almost ideal conditions for the development of the disease which may be in them and very favourable conditions for rotting. The expense of putting in a good system of ventilation in a cellar would be soon offset by the better condition in which the potatoes would keep, and hence the more profit there would be from them. If it is not considered wise to go to this expense every effort should be made to have as good a circulation about the potatoes as possible. Instead of piling the potatoes against the wall or on the floor, slats should be nailed a little apart about six inches or more from the wall. This will give a circulation of air behind the pile. A temporary floor should be put down about six inches above the permanent floor with cracks between the boards. This will permit air to circulate under and through the pile. Then if the piles have to be made very large, square ventilators of wood made of slats and running from the top to the bottom of the pile could be put in here and there through the pile. These with the ventilation afforded at the sides and bottom will keep the potatoes in much better condition than if they were in a solid pile. Another good plan is to keep the potatoes in large crates made with slats close enough together to prevent the potatoes getting out. The ventilation between these crates would assist very much in keeping the tubers in good condition. Thousands of bushels of potatoes are lost every year when there is disease in the crop by neglecting ventilation. The temperature of the cellar or store-house should be kept as nearly 33° to 35° F. as possible. The cooler potatoes are kept without freezing the better. It has already been stated how much the value of the tubers for seed is lessened by sprouting, but they are also much injured for eating. Moreover, if the potatoes are held over to sell in the spring there will be a great deal of shrinkage in weight if potatoes are allowed to sprout. It is important to have some means of letting cool air into the cellar towards spring when it is difficult to keep potatoes from sprouting. The cool air should be let in at night when the temperature is lowest and the cellar kept closed during the day.

Sometimes it is difficult to get all the crop to the cellar at digging time and when this is the case they may be put in piles of forty or fifty bushels and covered with straw with a little earth on top to keep them dry, more earth being put over the straw if the weather becomes cold. If the potatoes are diseased, however, it is not safe to pile them in this way and even if they are healthy piling in the field should be avoided if at all possible, as the crop is much easier to handle afterwards in the cellar than outside in the cold, perhaps, inclement weather If potatoes are found to be diseased at digging time a good plan is to fix up a place in the barn where it is quite dry and where frost can be kept out for a time and spread the potatoes out in as shallow piles as possible. The place, should, however, be made perfectly dark as potatoes soon deteriorate very much in quality if exposed to light.

Marketing.—There is usually more profit taking one year with another in selling potatoes as soon after digging time as possible. While occasionally when rot has been bad and the crop short throughout the country and one happens to have perfectly sound tubers it may pay to hold them over, yet on the whole it is wiser for the grower to sell at a fair price in the autumn as he thus avoids all the anxiety regarding the keeping of the crop and thus not take any risk from possible losses.

Some of the varieties of potatoes which are poor quality are freest from blight, hence these are becoming popular with some potato growers. Some of the potatoes of best quality, however, are also freest from blight. We believe that leaving everything else out of consideration it will pay a potato grower to grow varieties of good quality which are equally or more productive than those perhaps a little freer from blight, and spray them with Bordeaux mixture. He would then be in a position to offer the very best potatoes to his customers who would soon appreciate those of better quality. The question of how to market potatoes depends so much on local conditions that it is not considered desirable to go very fully into it here. The practice of the best growers is to sort and bag the potatoes just before they are ready to market them. Good machines for sorting and removing the sprouts from potatoes can now be obtained which lessens the labour very much. The sorter or separator represented by the illustration is made by Matthew Moody & Sons, Terrebonne, Que.



POTATO SORTER.

COST OF GROWING AND MARKETING ONE ACRE OF POTATOES.

Rent of land, one year	$ 3 00
Cost of 12 lbs. clover seed at 14 cts	1 68
Barnyard manure, 12 tons at $1 (⅓ exhausted in one year)	4 00
Ploughing in spring, 8 hours at 25 cts	2 00
Disc harrowing twice, 3 hours at 25 cts	0 75
Harrowing once with smoothing harrow	0 15
Drilling 2½ hours at 25 cts	0 62
Seed, 25 bushels at 40 cts	10 00
Cutting seed, one day	1 25
Planting seed, one day	1 25
Covering, 1¼ hours at 25 cts	0 31
Harrowing twice with smoothing harrow	0 30

COST OF GROWING AND MARKETING ONE ACRE OF POTATOES—*Concluded.*

Cultivating six times, 15 hours at 17½ cts.	$ 2 62
Hoeing once, one day	1 25
Paris green, 6 lbs at 19 cts.	1 14
Bluestone, 72 lbs. at 6 cts.	4 32
Spraying three times with Paris green, horse and men, 6 hours at 30 cts.	1 80
Spraying 4 times with Bordeaux mixture, horse and 2 men 8 hours at 30 cts.	2 40
Digging 3⅓ hours at 25 cts.	0 83
Picking up potatoes, 2½ days at $1.25	3 12
Storing 4 loads, 4 hours at 25 cts.	1 00
Sorting and marketing, man, 4 days at $1.25—$5; team, parts of, 2 days at $1.25—$2.50	7 50
Wear and tear on machinery and interest on money	0 85
	$ 52 14

The cost of growing an acre of potatoes as given in the preceding table is large but this expense is fully justified by the results which should be obtained if it is incurred. If the best methods are followed there should be no difficulty in getting 300 bushels per acre and the table of expenses is estimated on that yield. The amount of seed recommended, namely 25 bushels may seem large to many farmers who are in the habit of using from 10 to 12 bushels, but if the larger sets are tried the results will, we believe, fully justify the extra amount of seed. When a potato planter is used which places the sets in close contact with the soil and moisture the sets need not be as large and this item of expense would be reduced. If a potato planter were used the cost of planting would also be considerably reduced. The prices put for Paris green and bluestone may be less or may be a little more than one would have to pay. If buying in large quantities the prices would be lower. The cost of application will also vary according to the method employed, that given in the table being a maximum amount. It was thought best to have the various items of expense above rather than below what the actual cost would probably be on a large acreage.

VARIETIES OF POTATOES TESTED AT CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT., 1887-1905.

In the following table will be found a list of the named varieties of potatoes, with the exception of a few unnamed seedlings, which have been tested at the Central Experimental Farm since the year 1887 when the first potatoes were planted. In this list there are 590 names. Of these, 13 represent varieties which were sent for test which may be synonyms of others as no name of variety was given. There may also be a few synonyms among the others also. The total number of distinct varieties recorded in this table, is we believe, at least 563. In addition to these there were 281 seedlings originated at the Central Experimental Farm, which have been discarded making the total number of varieties tested named and unnamed, about 844. In addition to the name, the year when each variety was first secured and the last year it was planted are given, also the reasons for discarding a variety where this has been done.

In the column where notes are given as to the reason why a variety was discarded. 'I. P.,' stands for inferior productiveness; 'I. Q.'for inferior quality, and 'D. E.," for deep eyes. Some varieties although quite productive were not as heavy croppers as others and hence were not retained. It was not considered advisable either to continue varieties which were productive but of inferior quality and deep in the eye unless there was some other reason for continuing them.

Name of Variety.	Years When Tested.	Why Discarded.
Abundance	1887-1888	I.P.
Adirondack	1887-1890	I.P.
Alarich	1899-1901	I.P.
Alabaster	1899-1901	I.P.
Alexander Prolific	1889-1892	I.P.
Alexandria	1887-1888	I.P.
Algiers	1887 1889	I.P.
Algoma, No. 1	1891-1899	I.P.
Algoma, No. 2	1891	I.P.
Algoma, No. 3	1891-1892	I.P.
Alkohol	1887-1888	I.P.
Alma	1887-1888	I.P.
Almond Blue	1887-1888	I.P.
Alpha	1887-1890	I.P.
Ambrosia	1899-1904	I.P.
American Wonder	1888-1894-1905	
American Giant	1893-1905	
Amylon	1887-1889	I.P.
Anderssen	1887-1888	I.P.
Apollo	1899-1904	I.P.
Ashtop Fluke	1887-1888	I.P.; I.Q.
Ashleaf Kidney	1904-1905	
Asparagus	1887-1892	I.P.
August der Starke	1887-1888	I.P.
Aurora	1887-1888	I.P.; I.Q.
Australian	1887-1888	I.P.
Babbit	1905	
Balmoral	1890-1891	I.P.
Beauty of Hebron	1887-1902	I.P.
Beauty of Ottawa	1891	I.P.
Bedson	1890	I.P.
Beefsteak	1887-1889	I.P.
Bergeron (J. N. From)	1895-1903	I.Q.; D.E.
Bill Nye	1897-1902	I.P.
Bismark	1887-1889	I.P.
Bisquit	1887-1888	I.Q.
Bliss Triumph	1887-1891, 1899-1905	
Blue Bell	1890-1891	I.P.
Blue Cup	1892-1899	I.P.
Blucher	1887-1888	I.P.
Bombay	1887-1889	I.P.
Bovee	1897-1905	
Bovinia	1887-1888	I.P.; I.Q.
Brant	1890, 1892-1893	I.P.
Bras d'Or Seedling	1892-1895	I.P.
Brownell's Best	1887-1888, 1891	I.P.
Brownell's Beauty	1887-1888	I.P.
Brownell's Multiplier	1887-1888	I.P.; I.Q.
Brownell's Superior	1887-1889	I.P.
Brownell's Winner	1890-1891, 1902	I.P; I.Q.
Brosseau (A. S. From)	1897-1904	D.E.
Brown's Rot Proof	1895-1903	I.P.
Brunhilde	1887-1888, 1899-1904	I.P.
Bunder Landwirthe	1899-1901	I.P.
Burbank's Seedling	1887-1889, 1899-1904	I.P.
Burpee's Extra Early	1890-1903, 1905	
Burpee's Seedling, No 37	1889-1892	I.P.
Burpee's Superior	1889-1891	I.P.
Burnaby Mammoth	1893-1905	
Calico Early	1887-1891	I.P.
California Cup	1900-1901	I.P.
Callao Large	1887-1890	I.P.
Caillon	1887-1888	I.P.
Cambridge Russet	1898-1905	
Canadian Beauty	1898-1905	
Carman, No. 1	1895-1905	
Carman, No. 3	1896-1905	
Careless Match	1891-1892	I.P.
Centennial	1887-1889	I.P.
Ceres	1887-1888	I.P.; D.E; I.Q.
Chamaeleon	1887-1888	I.P.; I.Q.
Champion	1887-1888	I.P.; I.Q.
Champion of the Earlies	1898-1902	I.P.
Chas. Downing	1890-1899	I.P.
Chas. Fidler	1904-1905	
Chicago Market	1887-1902	I.P.
Churchill Seedling	1900-1902	I.P.
Circassienne	1887-1889	I.P.
Clark's Pride	1903-1905	
Clark's No. 1	1888-1902	I.P.
Clarendon	1890	I.P.
Clay Rose	1895-1905	
Climax	1887-1888, 1905	I.P.
Cockeryoats	1887-1888	I.Q.
Columbus	1897-1902	I.P.
Compton's Surprise	1887-1891	I.P.
Connolly, T., Seedling	1889	I.P.
Conqueror	1887-1891	I.P.
Corona Beauty	1890-1891	I.P.
Cornflower	1887-1888	I.Q.
Cosmopolitan	1899-1901	I.P.
Cottage	1887-1888	I.Q.
Countess	1887-1888	I.P.; I.Q.
Count Moltke	1887-1889	I.P.
Country Gentleman	1899-1905	I.P.
Craig Seedling	1898	I.P.
Crine's Lightning	1902-1905	
Crown Jewel	1889-1899	I.P.
Cyclop	1899-1904	I.P.
Dabersche	1887-1888	I.P.
Daisy	1890-1902	I.P.
Dakota Red	1889-1903	I.Q.; D.E.
Dalmahoy	1887-1889	I.P.
Dalmeny Beauty	1904-1905	
Darby	1890-1891	I.P.
Dark Red Seedling	1898-1901	I.P.
Darling, J., from	1898-1899	I.P.
Dawson City, from	1903-1904	I.P.
Daybreak	1903-1905	
Debreau, R, Seedling	1891-1892	I.P.
Delaware	1890-1905	
Deliciosa	1887-1888	I.P.
Delight	1889-1891	I.P.
Detroit	1887-1888	I.P.
Dewey	1905	
Diaeta	1887	I.P.
Discovery	1905	
Dobson's Early	1900-1902	I.P.
Doctor	1887-1889	I.P.
Doherty's Seedling	1898-1905	
Dooley	1901-1905	
Dr. Maerker	1899-1905	
Dreer's Standard	1894-1905	
Duana	1899-1901	I.P.
Dublin Prize	1901-1904	I.Q.
Duc de Magenta	1887-1888	I.P.
Duke of York	1905	
Dumfries Early White	1888-1891	I.P.
Dutch Blue	1901-1902	I.P.
Dutch Blue Flowering	1887-1888	I.P.
Dykeman	1887-1888	I.P.
Early Albino	1889-1892	I.P.
Early Andes	1898-1904	I.P.
Earliest of All	1893-1902	I.P.
Early Bird,	1887-1889	I.P.
Early Carter	1902-1905	
Early Dawn	1898-1902	I.P.
Early Eating	1890-1892	I.P.
Early Elkinah	1900-1905	
Early Envoy	1901-1905	
Early Excelsior	1905	
Early Fortune	1896-1899	I.P.
Early Gem	1892-1899	I.P.
Early Giant	1887-1888	I.Q.

Name of Variety.	Years when Tested.	Why Discarded.
Early Household	1887-1890	I.P.
Early Harvest	1895-1902	I.P.
Early Johnston	1904-1905	
Early Market	1899-1902	I.P.
Early Manistee	1905	
Early Manitoban	1890-1891	I.P.
Early May	1905	
Early Maine	1889-1891	I.P.
Early Michigan	1899-1903	I.P.
Early Norther	1894-1903	I.P.
Early Petoskey	1905	
Early Pride	1899-1902	I.P.
Early Puritan	1890-1903	I.P.
Early Ohio	1887-1905	
Early Rose	1887-1905	
Early Round Blue	1887-1888	I.P.; D.E.
Early Six Weeks	1895-1902	I.P.
Early St. George	1898-1903	
Early Summer	1900-1904	I.P.
Early Sunrise	1889-1903	I.P.
Early Sunlight	1904-1905	
Early Superior	1904-1905	
Early Short Topped	1887-1888	I.P.
Early Thorburn	1892-1899	I.P.
Early Trumbull	1905	
Early White Prize	1895-1905	
Edwards, R., Seedling No. 1	1894	I.P.
Edwards, R., Seedling No. 2	1894-1899	I.P.
Edwards, R., Seedling No. 3	1894-1899	I.P.
Egg	1897-1899	I.P.
Eightyfold	1905	
Elegant (Richters)	1887-1889	I.P.
Elbingen White	1887-1888	I.Q.
Emperor	1887-1888	I.P.
Emperor Forcing	1887-1888	I.Q.
Emperor William	1887-1891	I.P.
Empire State	1888-1905	
Empress of India	1887-1888	I.P.
Empress Queen	1904-1905	
Enormous	1899-1905	
Erfurt Early bound	1887-1889	I.P.
Erfurt Incomparable	1887-1889	I.P.
Erfurt Red Skin	1887-1888	I.P.
Erste Von Nassengrund	1888	I.Q.
Eureka	1887-1888	I.Q.
Eureka Extra Early	1901-1905	
Euphyllos	1887-1889	I.P.
Everett	1891-1905	
Evergood	1904-1905	
Extra Early Hero	1905	
Extra Ruper Crane	1888-1890	I.P.
Eye Carpenter	1887-1892	I.P.
Farmer's Blush	1887-1889	I.P.
Farinosa	1887-1888	I.Q.
Fillbasket	1897-1899	I.P.
Fidelia	1887-1890	I.P.
Filers	1887-1889	I.P.
Fierz	1887	I.P.
First Crop Ashleaf	1889-1891	I.P.
First, from Wassingram	1887	I.P.
Flemish Beauty (seedling)	1893-1905	
Flourball	1887-1888	I.Q.
Flour of Eden	1889-1892	I.P.
Fortyfold	1887-1888	I.P.
Frame Early	1887-1892	
Franz Duke	1899-1901	I.P.
Freeman	1894-1899	I.P.
French Red	1894-1898	I.P.
French White	1894-1896	I.P.

Name of Variety.	Years when Tested.	Why Discarded.
Freza	1899-1901	I.P.
Fullerton, J. K., from	1892-1894	I.P.
Ganea	1887-1888	I.P.; I.Q.
Garnet Chili	1887-1888	I.P.
Garnet Crimson	1887-1888	I.Q.
Gem of Aroostook	1899-1902	I.P.
Geo. H. Foraker	1889-1891	I.P.
Giant	1887-1888	I.P.
Giant Blue	1887-1889	I.P.
Giant Dutch Long	1887-1889	I.P.
Giant Early	1888	I.P.
Giant of Marmont	1887-1889	I.P.
Gleason Late Blue	1887-1892	
Goodrich Early	1887-1888	I.P.
Goodrich Late	1887-1892	
Golden Early	1887-1888	I.P.
Good News	1897-1899	I.P.
Grant	1890-1891	I.P.
Great Divide	1895-1902	I.P.
Great Eastern	1888-1891	I.P.
Green Mountain	1890-1903	I.P.
General Gordon	1893-1904	I.P.
Halberstadt	1887-1889	I.P.
Halton Seedling	1889-1893	I.P.
Hale's Champion	1892-1902	I.P.
Handsworth Early Prolific	1887-1889	I.P.
Harbinger	1893-1899	I.P.
Harlequin	1887-1888	I.P.
Hammelshainer Blue	1887-1888	I.Q.
Harris' Snowball	1905	
Harrison	1887-1889	I.P.
Harvester	1887-1888	I.Q.
Harvest King	1899-1902	I.P.
Heath	1887-1888	I.P.
Hercules	1887-1888	I.P.
Hertha	1887-1888	I.P.
Hibernia	1904-1905	
Holborn Abundance	1889-1905	
Hochheim	1887-1888	I.P.; I.Q.
Honeoye Rose	1897-1899	I.P.
Hopeful	1893-1899	I.P.
Houlton Rose	1897-1902	I.P.
Idaho	1887-1889	I.Q.
Ideal	1895-1899	I.Q.
Imperator	1889-1890	I.P.
Inez	1888	I.P.
Ionia Seedling	1905	
Irish Blue	1887-1888	I.P.
Irish Champion	1892-1893	I.P.
Irish Cobbler	1897-1905	
Irish Daisy	1895-1903	
I. X. L.	1893-1905	
Jackson's Improved	1887-1889	I.P.
Jackson's White	1887-1889	I.P.
James Nugget	1903-1904	I.P.
Japanese	1890	I.P.
Joanette	1887	I.P.
John Bull	1903-1905	
Joseph Rigault	1887-1888	I.P.; D.E.
Juana	1899-1904	I.P.
Jubilee	1899-1905	
Jumbo	1887-1889	I.P.
June	1905	
June Eating Crane	1888-1891	I.P.
Kaiser	1901-1905	
King of the Earlies	1887-1891	I.P.
King of Michigan	1901-1903	I.P.
King of the Roses	1897-1899	I.P.
King of the Russets	1889-1891	I.P.
King of the Valley	1891	I.P.
Kidney August	1887-1890	I.P.
Kidney Blue	1887-1888	I.P.

Name of Variety.	Years when Tested.	Why Discarded.
Kidney Degun's Yellow	1887-1889	I.P.
Kidney English	1888-1890	I.P.
Kidney Kirchners	1887-1888	I.P.; I.Q.
Kidney Kings White	1887-1889	I.P.
Kidney Late White	1887-1888	I.P.
Kidney Margolin	1887-1889	I.P.
Kidney Red	1887	I.P.
Kidney Red Skinned	1887-1888	I.P.
Kidney Royal White	1888	I.P.
Koppe	1887-1888	I.P.
Kyle, R. J., from	1892	I.P.
Lark's Eye	1887-1889	I.P.
Larkson, from	1887-1888	I.P.
Lady Finger	1889-1892	I.P.
Late Puritan	1894-1905	
Late Red Large	1887-1888	I.Q.
Late Rose	1887-1889, 1891-1893	I.P.
Late Rose (Blue)	1887-1888	I.Q.
Late Rose (White)	1887-1889	I.P.
Lee's Favorite	1899-1901, 1903.	I.P.
Lemieux, from	1892	D.E.
Leila	1899-1901	I.P.
Lightning Express	1897-1899	I.P.
Light Red Seedling	1898-1901	I.P.
Lippian Rose	1887-1889	I.P.
Lira	1887-1889	I.P.
Livingston	1899-1903	I.P.
Livingston's Banner	1899-1902	I.P.
Lizzie's Pride	1893-1902	I.P.
Lord Mayor	1887-1888	I.P.
Lortie. E., from	1895-1898	I.P.
London	1890-1899	I.P.
Lowe, John, from	1891-1892	I.P.
Mackintosh, D.R., from	1897-1898	I.P.
Magnum Bonum (American	1887-1889	I.P.
Magnum Bonum (Sutton's)	1887-1888	I.P.
Magnum Bonum, Select (Carter)	1889-1891	I.P.
Maggie Murphy	1895-1903	I.Q.
Malden's Recorder	1905	
Mammoth Pearl	1900-1905	
Mammoth Prolific	1887-1891	I.P.
Manhattan	1887-1890	I.P.
Manitoba Kidney	1890-1891	I.P.
Manitoba Kidney White	1890-1899	I.P.
Matchless	1887-1889	I.P,
Matador	1887-1889	I.P.
Martins	1894-1899	I.P.
Maule's Thoroughbred	1897-1905	I.P.
Mayflower Early	1887-1889	I.P.
May Queen Early	1887-1903	I.P.
Member of Parliament	1887-1890	I.P.
Merrill	1905	
Meteor	1899-1901	I.P.
Milky White	1887-1888	I.P.
Million Dollar	1905	
Mills' Prize	1898-1902	I.P.
Minister	1889-1891, 1892.	I.P.
Mohawk	1887-1888	I.P.
Montana Bluff	1900-1905	
Monroe County	1893-1899	I.P.
Money Maker	1895-1905	
Morgan's Seedling	1903-1905	
Murray, D., Seedling No. 1	1902-1904	I.P.
Murray, D., Seedling No. 2	1902-1903	I.P.
Morgan's White	1903-1905	
Mrs. Foraker	1889-1890	I.P.
Mountain Rose	1888	I.Q.

Name of Variety.	Years when Tested.	Why Discarded.
Mulhouse	1887-1888	I.P.; I.Q.
McCord, from	1897-1899	I.P.
McIntyre	1890-1891, 1900-1903	I.P.; D.E.
McKenzie, Geo., from	1892-1899	I.P.
McMurray, Thos., Seedling	1894-1895	I.P.
Myatt's Ashleaf	1905	
Napoleon	1887-1888, 1895-1905	
Naught Six	1905	
Nettleleaved	1887-1888	I.Q.
Neue Rothe Salat	1899-1904	I.P.
New Badger State	1889-1891	I.P.
New Queen	1895-1903	I.P.
New Variety, No. 1	1894-1902	I.Q.; D.E.
Niagara	1887-1889	I.P.
Ninetyfold	1905	
Nine Weeks	1887-1888	I.Q.
Northern Beauty	1901-1905	
Noroton Beauty	1905	
Norcross	1905	
Northern Star	1904-1905	
Northern Spy	1893-1902	I.Q.; D.E.
Nott's Peachblow	1903-1904	I.P.; D.E.
Nudel Red	1887-1888	I.P.
Ockel's Rio Frio	1887-1888	I.P.
Odin	1887-1888	I.P.
Ohio Gunner	1889-1891	I.P.
Ohio Junior	1897-1902	I.P.
Oneida	1887-1889	I.P.
Onion Early	1887-1890	I.P.
Onion Red Skinned	1887-1888	I.Q.
Oregon Beauty	1897-1899	I.P.
Orphans	1895-1899	I.P.
Oxford	1887-1888	I.P.; I.Q.
Paris Forcing	1887-1888	I.Q.
Paris Prize	1887-1888	I.Q.; D.E.
Paragon (Thorburn's)	1887-1891	I.P.
Patate Belge	1897-1898	I.P.
Paterson's Albert	1887-1889	I.P.
Paterson's Blue	1887-1890	I.P.
Paterson's Blue Kidney	1887-1888	I.P.
Paterson's Napoleon	1887-1888	I.P.; I.Q.
Paterson's Red Kidney	1887-1888	I.P.
Paterson's Victoria	1887-1888	I.P.
Pat's Choice	1902-1905	
Pauline Lucca	1887-1888	I.P.
Peach Blow	1887-1888, 1898-1904	D.E.
Peach Blow (red skinned)	1887-1888	I.Q.
Peach Blow (Foster's Early)	1887-1888	I.P.
Peach Blow (improved)	1887-1888	I.P.; I.Q.
Pearl of Home	1891	I.P.
Pearce's Extra Early	1893-1902	I.P.
Pearce's Prize Winner	1893-1896, 1898-1902	I.P.
Pearce	1900-1905	
Pearl	1887-1888	I.P.
Pearl of Savoy	1887-1891, 1905.	
Peerless	1887-1888	I.P.
Peerless Junior	1895-1899	I.P.
Peck's Early	1903-1905	
Penn Manor	1899-1905	
Penzance Kidney	1892-1893	I.P.
Perle	1899-1901	I.P.
Perron, A., from No. 1	1898	I.P.
Perron, A., from No. 2	1898	I.P.
Pesca	1887-1888	I.P.
Pingree	1901-1905	
Pink Eye	1898-1905	
Pine Cone	1887-1889	I.P.

Name of Variety.	Years when Tested.	Why Discarded.
Pio Nano	1887-1888	I.P.
Polaris	1893-1903	I.P.
Pomeranian Red	1887-1888	I.P.
Pootaluck	1889-1891	I.P.
Potentate	1905	
Polyganos	1887-1888	I.P.
Prairie Seedling	1887-1891	I.P.
Preston	1890-1891	I.P.
Price, from Holland	1887-1889	I.P.
Pride of America	1887-1891	I.P.
Pride of the Market	1894-1902	I.P.
Pride of the Table	1894-1899	I.P.
Pride of Tunbridge	1905	
Prime Minister	1887-1891	I.P.
Prince Bismarck	1889	I.P.
Prince Frederick Charles	1887-1888	I.Q.
Prize Taker	1895-1902	I.P.
Prolific Breezes	1887-1889	I.P.
Prolific Rose	1899-1904	I.P.
Purple and Gold	1887-1889	I.P.
Pyke, Geo., from	1900-1901	I.P.
Quaker City	1897-1903	I.P.
Quarantine de la Halle	1887-1888	I.P.
Queens	1887-1888	I.Q.
Queen of Potatoes	1887-1888	I.Q.; D.E.
Queen of the Valley	1887-1888, 1891-1899	I.Q.
Quick Crop	1903-1905	
Quick Lunch	1905	
Raspberry Leaved	1887-1889	I.P.
Rawdon Rose	1897-1905	
Reading Giant	1894-1902	I.P.
Record	1895-1898	I.P.
Red Fish	1887-1888	I.P.
Red Mouse	1887-1888	I.P.; I.Q.
Red Rock	1900-1904	I.P.
Red River Valley	1891-1893	I.P.
Reeve's Rose	1897-1905	
Reinish Early Kidney	1887-1889	I.P.
Reliance	1905	
Richter's Gem	1887-1889	I.P.
Richter's Improved	1887-1891	I.P.
Richter's Schneerose	1887-1892	I.P.
Rio White	1887-1888	I.P.
Rochester Rose	1895-1905	
Rockwood	1890-1891	I.P.
Rose of Erin	1898-1902	I.P.
Rosedale	1890	I.P.
Rose's Beauty of Beauties	1890-1892	I.P.
Rose of the North	1898-1902	I.P.
Rose No. 9	1897-1905	
Rose's New Giant	1888-1891	I.P.
Rose's New Invincible	1891	I.P.
Rosy Morn	1887-1893	I.P.
Rothrant	1887-1890	I.P.
Rough Coat Cup	1902-1904	I.P.
Rough Diamond	1889-1892	I.P.
Rouge Royale	1905	
Ruby	1887-1891	I.P.
Rural Blush	1889-1905	
Rural No. 2	1889-1892, 1896-1903	I.P.
Russell's Seedling	1894-1898	I.P.
Rust Proof	1905	
Sabean's Elephant	1895-1905	
Sachsen Yellow Fleshed Onion	1887-1888	I.P.
Sago Black	1887-1888	I.P.
Satisfaction	1894-1899	I.P.
Saunders	1890	I.P.
Scotch Blue	1887-1888	I.P.; I.Q.
Scotch Champion	1888-1892	I.P.
Scottish Queen	1887-1888	I.Q.
Scotch Mountain Rose	1887-1888	I.P.; D.E.
Schoolmaster	1887-1890	I.P.
Seattle, from	1892-1903	
Seboo	1887-1888	I.P.
Seed	1887-1888	I.P.
Seedling No. 214 (C. E. F.)	1895-1902	D.E.
Seedling No. 230 (C. E. F.)	1894-1902	D.E.
Seedling Rock	1887-1888	I.P.
Seedling No. 7 (Agassiz)	1896-1904	I.Q.
Semmel	1887-1888	I.Q.
Seneca Queen	1899-1902	I.P.
Sharpe's Victor	1905	
Sharpe's Seedling	1887-1903	I.P.
Sieberhauser	1887-1888	I.P.
Siegfried	1887-1888, 1899-1901	I.P.
Silver Dollar	1900-1903	I.P.
Silverskin	1887-1888	I.P.
Sir John Llewellyn	1905	
Sir Walter Raleigh	1897-1903	I.P.
Six Weeks	1891	I.P.
Six Weeks Long White	1887-1888	I.P.
Six Weeks Long White Improved	1887-1888	I.P.
Six Weeks Round Blue	1887-1889	I.P.
Six Weeks Round White	1887-1890	I.P.
Small Frying	1887-1888	I.P.; D.E
Snowball	1902-1905	
Snowdrop	1905	
Snowflake	1887-1891	I.P.
Sovereign	1887-1888	I.P.; I.Q.
South Brazilian	1887-1888	I.P.
Stambulow	1899-1901	I.P.
Stanley	1890-1891	I.P.
State of Maine	1890-1905	
Star of the East	1905	
Stonewall	1890-1892	I.P.
Stourbridge Glory	1895-1899	I.P.
Strachan, Alex., from	1900	I.P.
Stray Beauty	1889-1891	I.P.
Sugar	1887-1891	I.P.
Sukreta	1887-1891	I.P.
Sulcika	1899-1901	I.P.
Summit	1889-1902	I.P.
Surprise	1889-1891	I.P.
Sutton's Abundance	1895-1899	I.P.
Sutton's Main Crop	1895-1898	I.P.
Sutton's Red Skinned Flour Ball	1887-1888	I.Q.
Sutton's White Fleshed Onion	1887-1888	I.P.
St. Jean	1887-1888	I.P.
St. Johns Bay	1887-1888	I.Q.
St. Patrick	1887-1891	I.P.
Swiss Snowflake	1897-1905	
Symonds, J. (Black Seedling)	1891	I.P.
Table King	1894-1899	I.P.
Telephone	1887-1890	I.P.
Think of Me	1891	I.P.
Thorburn	1888-1897, 1900-1902	I.Q.
Thusnelda	1887-1888	I.Q.
Tilley R., from	1901	I.P.
Todd's Seedling	1902-1904	I.P.
Triumph de Pomerania	1887-1888	I.Q.
Trophime	1887-1889	I.P.; I.Q.
Trophy	1887-1888	I.Q.
Troy Seedling	1895-1903	I.P.
Tuttle's Excelsior	1887-1888	D.E.
Truffle	1887-1888	I.P.

Name of Variety.	Year when Tested.	Why Discarded.	Name of Variety.	Year when Tested.	Why Discarded.
Twentieth Century	1899-1902	I.P.	Wesel	1899-1901	I.P.
Uncle Sam	1897-1905		White Albino	1904-1905	
Unica	1899-1901	I.P.	White Beauty	1893-1902	
Up to Date	1901-1903	I.P.	White Elephant	1887-1889, 1891-1892, 1897-1905	
Vanguard	1887-1893	I.P.			
Vanier, D., from	1892-1903	I.Q.			
Van Deman's Earliest	1902-1905		White Giant	1898-1902	I.P.
Venus	1887-1888	I.P.; I.Q.	White Mammoth	1905	
Vermont	1887-1893	I.P.	White Star	1887-1891	I.P.
Vermont Gold Coin	1903-1905		White Sprout	1887-1890	I.P.
Victoria	1890-1901	I.P.	White Queen	1887-1888	D.E.
Victoria Pale Red	1887-1888	I.Q.	Williams Early	1887-1889	I.P.
Vicktor	1905		Woltman	1899-1905	
Victor Rose	1895-1899	I.P.	Wonderful (Hammond's)	1901-1905	
Vigorosa	1899-1902	I.P.	Wonder of the World	1887-1893, 1896-1902	I.P.
Vick's No. 9	1903-1905				
Vick's Extra Early	1892-1905		World's Fair	1894-1899	I.P.
Voodle Red	1887	I.P.	Yellow Rose	1887-1888	I.P.; I.Q.
Wall's Orange	1900-1904	I.P.	Zwickau	1887-1888	I.P.
Washington	1905				

SUMMARY.

Although the potato is a very important food product of Canada the methods of culture can be much improved.

The potato succeeds well in Canada almost everywhere where the season is long enough for the tubers to develop before the tops are killed by frost.

There is no farm crop the yield of which can be increased so much by one season's work as the potato.

Potatoes have been grown at the rate of over 700 bushels per acre in small plots at the Central Experimental Farm. The average yield for the whole of Canada was about 123 bushels when the last census was taken in 1901.

The potato is a native of South America and Mexico and introduced into Ireland in 1585 or 1586 and from there to England.

New varieties of potatoes may be originated from seed, by bud variation, or changed by selection.

The twelve most productive varieties grown at the Central Farm for five years are: Dr. Maerker, Late Puritan, Burnaby Mammoth, Money Maker, Carman No. 1, Dreer's Standard, Sabean's Elephant, Canadian Beauty, Rural Blush, I.X.L., Pearce, Clay Rose.

The six most productive early varieties for five years are: Irish Cobbler, Early Elkinah, Vick's Extra Early, Rochester Rose, Rawdon Rose.

Some of the earliest varieties are: Early Snowball, Eureka Extra Early, Burpee's Extra Early, Rochester Rose, Bliss Triumph, Early Ohio.

The twelve varieties freest from blight are: Dr. Maerker, Late Puritan, Burnaby Mammoth, Carman No. 1, Dreer's Standard, Sabean's Elephant, Rural Blush, Clay Rose, Rose No. 9, Holborn Abundance, State of Maine, Swiss Snowflake.

Varieties may be affected either favourably or unfavourably by change of seed.

Potatoes succeed best in a moist, somewhat cloudy and temperate climate and in a rich, deep, friable, warm, sandy loam soil with good natural drainage, a constant though not too great a supply of moisture and well supplied with decayed or decaying vegetable matter.

A crop of 200 bushels of potatoes exclusive of the potato tops, removes from the soil approximately 40 lbs. nitrogen, 20 lbs. phosphoric acid, and 70 lbs. potash.

Potatoes succeed well after clover, there being an average increase in a three years' test of 37 bushels per acre where clover was used than where it was not.

Heavy manuring with barnyard manure is not recommended, but the use of a moderate quantity is advised applied on the clover in the autumn. If used in the spring the manure should be well rotted.

Chemical fertilizers, if used, should be applied at the rate of 500 to 800 lbs. or more per acre in the proportion of 250 lbs. nitrate of soda, 350 lbs. superphosphate, and 200 lbs. sulphate of potash or muriate of potash.

The soil should be very thoroughly prepared; the better the preparation, the better the crop is likely to be.

The best time to plant varys; it depends largely on the condition of the ground and spring frosts. As a rule, the best time is as soon as possible after danger from frost is past.

Sets should be cut from medium or large potatoes and planted, and covered as soon as possible after planting. If allowed to wither the crop will be less. An increased yield will be obtained by coating the sets with land plaster, gypsum or lime, especially if potatoes are cut a few days before planting. A set should have a large amount of flesh and about three eyes.

The best depth to plant is from four to five inches.

Potatoes should be planted in rows 30 inches apart with a set from 12 to 14 inches apart in the rows.

Potato planters are very satisfactory.

The crop of potatoes will usually increase in proportion to the number of times the potatoes are cultivated during the growing season. There was found to be an increase of 40 bushels per acre in a crop of potatoes cultivated six times over those cultivated three times.

Level cultivation will sometimes give better results than ridging, and vice versa. Where the soil is stiff, ridging is advisable. Where the soil is loose and liable to suffer from drought in a dry time, level culture is recommended. Where the soil is both loose and moist, ridging will usually give best results.

Mulching with straw is too expensive and results do not justify its use.

Potatoes can be forced by some days by sprouting the potatoes before planting.

The crop of marketable potatoes can be almost doubled by having three weeks' growth in September.

Potato tops should be protected from insects and diseases as the yield will be in proportion to the leaves uninjured.

The Colorado Potato Beetle and Cucumber Flea Beetle are the most injurious insects. The former can be killed by using Paris green, and the latter can be prevented from doing injury by Bordeaux mixture and Paris green.

The principal diseases affecting the potato are Early and Late Blight and Rot, and Potato Scab. The two former may be prevented by spraying thoroughly with Bordeaux mixture, beginning before the disease appears and keeping the vines covered. From three to four sprayings are sufficient. In a three years' test the increase in yield by spraying with Bordeaux mixture was 94 bushels. The total cost per acre will be from four to six dollars.

The spores of potato scab may be destroyed on the potato before planting by soaking the tubers for two hours in a solution of Formalin or for one and a half hours in a solution of Corrosive sublimate.

Spraying mixtures should be applied at the proper time and thoroughly if good results may be expected.

It is important to success to have a good spray pump and pure spraying materials.

Good potato diggers are now on the market by which potatoes can be dug more economically than with the plough or fork. Potatoes should be dug in dry weather so that they will be dry when taken to the cellar.

If the potatoes are diseased it is best to leave them in the ground as long as possible.

Tubers should be stored in a dry, cool, well ventilated cellar and kept at a temperature between 33° and 35° F. if possible.

It is usually more profitable to market potatoes in the autumn than to store them.

Good machines for sorting potatoes can now be obtained.

The cost of growing a 300 bushel per acre crop of potatoes is estimated at $52.14, although this will be reduced considerably on large areas where the most modern machinery is used.

The number of varieties of potatoes tested at the Central Experimental Farm from 1887 to 1905 is about 844.

5
132
.E22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

THE MILLING AND CHEMICAL VALUE

OF THE

GRADES OF WHEAT

IN THE

MANITOBA INSPECTION DIVISION

CROP OF 1904

PART I

BY

CHAS. E. SAUNDERS, Ph. D.,
Experimentalist

PART II

BY

FRANK T. SHUTT, M.A.,
Chemist of the Dominion Experimental Farms

BULLETIN No. 50

JUNE, 1905

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

THE MILLING AND CHEMICAL VALUE

OF THE

GRADES OF WHEAT

IN THE

MANITOBA INSPECTION DIVISION

CROP OF 1904

PART I

BY

CHAS. E. SAUNDERS, Ph. D.,
Experimentalist

PART II

BY

FRANK T. SHUTT, M.A.,
Chemist of the Dominion Experimental Farms

BULLETIN No. 50

JUNE, 1905

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

To the Honourable the Minister of Agriculture,

Sir,—I have the honour to submit for your approval, Bulletin No. 50 of the Experimental Farm Series on the Milling and Chemical Value of the Grades of Wheat in the Manitoba Inspection Division, Crop of 1904.

The Milling and Baking tests reported on in Part I. have been conducted by Dr. C. E Saunders, Experimentalist, while the results of a chemical study of the grain and flour of these grades carried on by Mr. F. T. Shutt, Chemist of the Experimental Farms, are presented in Part II.

The investigations which are reported upon in this bulletin were undertaken under your instructions, in response to a request received from the Manitoba Grain Growers Association, asking that the Experimental Farm staff should determine as accurately as possible the value of each grade of wheat (in the Manitoba Inspection Division) for milling purposes, and also from the standpoint of chemical composition.

This subject is one of deep interest to the farmers of the Canadian North-west, and every effort has been made to make the investigation thorough and complete. The uniformity of the results obtained by these independent workers gives evidence of the care and accuracy with which the work has been conducted, and will doubtless inspire confidence in the reliability of the conclusions reached. I trust that the facts presented in this bulletin will be helpful in leading to just conclusions in reference to this important inquiry.

I have the honour to be

Your obedient servant,

Wm. SAUNDERS,
Director of Experimental Farms.

Ottawa, June 6, 1905.

PART I.

THE MILLING VALUE OF THE GRADES OF WHEAT

By Chas. E. Saunders, B.A., Ph.D., *Experimentalist.*

METHOD OF SELECTING THE WHEAT.

In order that definite conclusions may be drawn from tests and analyses of the wheat of different grades it is evident that *the grain must in every case be thoroughly representative of the average of the grade.* Individual lots of grain, each grown in one field, are obviously untrustworthy (and may be quite misleading) when general conclusions are to be drawn; because they may be either above or below the average of the grade (though not, of course, below the legal standard), and may possess peculiarities due to the soil or climate of the district in which they were grown or due to the variety of wheat sown.

Through the courtesy of Mr. David Horn, the Chief Inspector of Grain, we were able to obtain for this investigation from the Winnipeg inspection office a sufficient quantity of wheat of each grade made up by the mixing of small quantities taken from a number of different car-loads from various sections of the country. These samples of wheat were screened, under Mr. Horn's direction, to bring them to the condition in which the grain leaves Fort William.

These composite lots may therefore be depended upon to represent accurately the *average* of the different grades as shipped out of Fort William. This average is, of course, above the legal standard, which defines only the minimum of quality required for each grade.

The grades received were No. 1 Hard, Nos. 1, 2 and 3 Northern, No. 4 Extra, No. 4, No. 5, Feed and No. 2 Feed. A sample of frozen wheat, No. 5 Frosted, was also obtained in addition to the regular grades mentioned.

CLEANING THE WHEAT.

The grain as received from Mr. Horn was subjected to further cleaning before being milled. This cleaning was designed to remove oats, barley, weed seeds, &c., and also to take off to a certain extent the hairs from the tips of the wheat kernels.

The loss of weight caused by this cleaning, and the weight per bushel of the cleaned samples are given in the following table:—

	Loss in Weight on cleaning.	Weight per bushel cleaned.
No. 1 Hard	0·2 per cent	64 lbs.
No. 1 Northern	0·6 "	63¼ "
No. 2 "	0·8 "	62¼ "
No. 3 "	1·0 "	60½ "
No. 4 Extra	1·4 "	58¼ "
No. 4	1·2 "	58¾ "
No. 5	1·8 "	57 "
Feed	1·8 "	56 "
No. 2 Feed	2·0 "	53½ "
No. 5 Frosted	0·8 "	59 "

It will be noticed in the above table that the loss on cleaning increases, and the weight per bushel decreases in passing from the higher to the lower grades. No. 4, however, occupies a somewhat anomalous position.

METHOD OF MILLING.

The different kinds of wheat were ground in an experimental (roller process) flour mill, adapted for the use of small quantities of grain. A fixed system of milling, such as the large mills employ, was not used. Such systems are adapted specially to the higher grades of wheat and cannot therefore be expected to give accurate results when low grades are being ground. In this respect, therefore, an experimental flour mill has a distinct advantage over a larger, fixed system; because the treatment of each kind of wheat can readily be altered to suit its special requirements. But whenever comparisons are being made between different lots of wheat of good quality and similar in character, a fixed system is to be preferred.

Before milling, the wheat was moistened with about three per cent of water and was allowed to stand for about one hour. The time and the amount of water added varied somewhat according to the nature of the wheat.

Four breaks were generally found sufficient when the higher grades were being milled. The first break was made very light, and the first break flour (usually less than one per cent) was always put into the low grade flour. The flour from the other breaks was put into the 'straight' grade, except in the case of No. 2 Feed which gave break flour so dark in colour that it could only be put into the low grade.

The number of reductions varied somewhat with the character of the wheat which was being ground.

After each operation, the mills and sieves were thoroughly brushed out, in order to make the results as accurate as possible, quantitatively. This cleaning entirely prevented the mixing of flour from one lot of wheat with that from any other, (which always occurs in large mills), but it made the colour of the flour less brilliant than it would otherwise have been.

The loss in milling was usually about three per cent.

FLOUR, SHORTS AND BRAN.

Since the terms *flour*, *shorts* and *bran* are scarcely capable of rigid definition, it seems necessary to explain as accurately as possible the meanings attached to them in this investigation. It is a perfectly simple matter to make seventy per cent or more of *flour* from even the very lowest grades of wheat, provided the definition of the term *flour* is made sufficiently broad. A little additional grinding will also always transfer a considerable quantity of bran into the shorts, bringing the latter to a relatively large bulk. Therefore, the different proportions of the products obtained by various investigators are not necessarily contradictory, even though they may seem to be so at first sight. In the present investigation an effort has been made to use the terms *flour, shorts* and *bran* in exactly the same sense in every case.

Flour.—This material all passed through No. 10 bolting silk and was classified according to colour into three grades, first, second and low. The first and second grades were then mixed and are referred to as *straight* flour. Care was taken to include in the straight flour all the material which seemed, by its colour, to be fit for the making of bread of fair quality. The low grade flour could of course be used for bread making, but so far as the writer is aware, such material as this is not so used in Canada, but is employed in the feeding of animals. Bread made from it is certainly most uninviting.

Shorts.—This product passed through No. 20 silk gauze and was retained on No. 10 bolting silk.

Bran.—The material finally retained on No. 20 silk gauze was designated as bran.

The proportion of shorts to bran did not vary very much in the first seven grades, the shorts being a little less in amount than the bran. In the last two grades the shorts and bran were about equal. As these differences have very little significance, and as the relative proportions of the two products can so readily be altered by slight changes in the method of milling, it seems unnecessary to report upon them separately. The totals only are therefore given.

The following table gives the yield of flour, shorts and bran, obtained from the different grades of wheat. These milling tests were done in duplicate and the figures given are the average of the two.

YIELD OF FLOUR, SHORTS AND BRAN.

(The figures are percentages of the total products obtained).

—	Straight Flour.	Low grade Flour.	Total Flour.	Shorts and Bran.
No. 1 Hard	64½	6½	71	29
No. 1 Northern	62	7½	69½	30½
No. 2 Northern	61	8	69	31
No. 3 Northern	59½	8	67½	32½
No. 4 Extra	56	10	66	34
No. 4	52	14	66	34
No. 5	45½	14½	60	40
Feed	38	21	59	41
No. 2 Feed	22	27	49	51
No. 5, Frosted	45	16	61	39

It will be seen that the amounts of straight flour and of total flour decrease as we pass from the higher to the lower grades; while the amounts of low grade flour and of shorts and bran increase. These changes are fairly regular, though the differences between any two grades become much greater as the lowest grade is approached.

As already stated, the straight flour contains, in each instance, all the flour that seemed (from its colour) to be suitable for bread-making.

The large proportion of low grade flour produced from the poorest samples of wheat shows clearly their inferior character.

BREAK FLOUR AND PURIFIED MIDDLINGS.

It may be of interest, from a miller's point of view, to state the proportions of break flour and of purified middlings obtained from the different grades. The figures for the break flour represent the average of three determinations. The purified middlings were determined once.

Patent flour was not made, but the quantity of purified middlings produced will give a fair idea of the amount of patent flour which might be obtained from each grade.

The middlings were made in the usual way and were then purified by sifting and by the use of a current of air to remove bran particles. The purified middlings passed through No. 50 silk gauze and were retained on No. 9 bolting silk. The break flour passed through No. 10 silk.

The figures given below are percentages of the wheat ground.

	Break Flour	Purified Middlings.
No. 1 Hard	8	47
No. 1 Northern	8	45
No. 2 Northern	9	43
No. 3 Northern	9	41
No. 4 Extra	8	38
No. 4	9	36
No. 5	7	32
Feed	6	26
No. 2 Feed	5	16
No. 5 Frosted	6	39

The break flour from the lower grades was darker in colour than that from the higher grades; and the purified middlings from the lower grades did not possess the same rich, yellowish oolour as those from higher grades.

COLOUR OF THE FLOUR.

The straight flours made from the different grades were all much alike in colour, in the dry state; but the flour from the lower grades was less creamy and of a rather grayish tint.

After moistening and drying, differences of considerable importance could be observed. The flour from the first six grades was all of about the same colour, No. 5 and No. 5 Frosted were slightly darker, while Feed and No. 2 Feed were of a decided brownish-gray tint.

BAKING TESTS.

Many baking tests were conducted with the straight flours from the different grades of wheat. These tests were made rather severe so as to bring out clearly any differences which there might be in the strength of the various flours. Slightly different methods of fermentation of the dough were tried, but in each case the whole of the flour was made up into dough at the commencement of the operation. This was kneaded down twice, in addition to the very thorough kneading which it received at the beginning. The same quantities of flour, salt, yeast and sugar were always used, and water was added until all the samples of dough were as nearly as possible of uniform consistency. The fermenting cupboard was kept at about 33° C. (=91° F.), and the bread was baked at about 205° C. (=401° F). When cool, the weights and volumes of the loaves were ascertained.

WATER ABSORBED IN BREAD-MAKING.

The amount of water absorbed and retained by any flour when made into bread is a very important consideration in determining its value to the baker. The following table gives the averages of a number of different bakings of the straight flour from each grade of wheat. As the loaves made were quite small and were thoroughly baked, the amount of water retained was not so large as it would be in ordinary bread making. The results are, however, strictly comparable throughout:

	Weight of bread made from 100 parts of flour.	Number of Bakings.
No. 1 Hard	137½	9
No. 1 Northern	137	5
No. 2 Northern	135	6
No. 3 Northern	136	4
No. 4 Extra	134	5
No. 4	136½	4
No. 5	136	6
Feed	137	4
No. 2 Feed (not sufficient flour for repeated tests).		
No. 5 Frosted	138	6

Most of these differences in water absorption are too small to be of much importance; but the rather high position occupied by the flour from No. 5 Frosted wheat is interesting.

VOLUME OF THE LOAVES FROM DIFFERENT FLOURS.

The cubic volumes of the loaves produced in the different bakings were carefully determined in all cases. The results obtained, however, showed very few variations of interest. There was no difficulty in making excellent bread (as light as was desired) from almost every one of the samples of flour, though they did not all give their best results under exactly the same conditions. In general terms it may be said that flour from the lower grades acted better with rather long fermentation, while flour from the higher grades required somewhat shorter periods.

Some of the lower grades (No. 4 Extra, No. 4, No. 5 and No. 5 Frosted) gave dough which felt rather unusual and seemed to possess less elasticity than that made from the higher grades; but, when properly treated, very good bread was produced from it.

The flour from Feed wheat gave bread of somewhat less volume than the others, while with No. 2 Feed it was very difficult to make light bread at all.

COLOUR OF THE BREAD.

The colour of the bread made from the different flours varied only slightly from No. 1 Hard down to No. 5 and No. 5 Frosted, though the bread from these lower grades was certainly not quite equal in colour to that made from No. 1 Hard wheat. Below No. 5 there was a very distinct darkening. The colour of the bread made from Feed wheat was quite dark and unatractive, while that from No. 2. Feed was distinctly worse. The flavour of the bread in these two instances was also poor.

Conclusions from Baking Tests.

We may conclude from the baking tests that the straight flours made in this investigation were all suitable for bread making except those from Feed and No. 2 Feed wheat. These latter may be entirely condemned. The writer has never seen any such flour used for bread making, and it is not probable that it could be sold at any price for that purpose in Canada.

It may therefore be safely concluded that Feed and No. 2 Feed wheat have no milling value whatever, and that their actual worth is to be determined by their usefulness as food for chickens or other animals, either as whole grain or in the ground condition. Chemical analysis will therefore give a much better idea of the value of these two grades than any milling and baking tests.

VALUES OF MILL PRODUCTS.

Having eliminated the lowest two grades an attempt will now be made to ascertain the relative values of the mill products obtained from the remaining grades of wheat. In order to do this it is necessary to re-state the amounts of the different products obtained in terms of *uncleaned* wheat, the material which the miller purchases.

In preparing this table a deduction has been made for the loss in cleaning the wheat (particulars of which have already been given), and a further allowance of three per cent for loss in milling.

Small fractions are disregarded as in the previous tables.

YIELD OF FLOUR, SHORTS AND BRAN FROM 100 LBS. OF UNCLEANED WHEAT.

——	Straight Flour.	Low Grade Flour.	Shorts and Bran.
	Lbs.	Lbs.	Lbs.
No. 1 Hard	62½	6	28
No. 1 Northern	60	7	29½
No. 2 Northern	59	7½	30
No. 3 Northern	57	7½	31
No. 4 Extra	53½	9½	32½
No. 4	50	13	32½
No. 5	43½	13½	38
No. 5 Frosted	43½	15½	37½

After a careful study of the prices of flour, shorts and bran in Winnipeg during the past winter, the following values were selected as approximately correct for the products made in these milling tests:—

Straight flour	$2.50	per 100 lbs.
Low grade flour	1.10	"
Shorts and bran (mixed)	0.70	"

Even though these prices may not be strictly accurate, they will serve very well for the calculation of the relative values of the mill products obtained from a bushel of wheat of each different grade.

The following table shows the

VALUE OF THE MILL PRODUCTS OBTAINED FROM A BUSHEL OF WHEAT.

Grade.	Straight Flour.	Low Grade Flour.	Shorts and Bran.	Total.
	$ cts.	$ cts.	$ cts.	$ cts.
No. 1 Hard	0 94	0 04	0 12	1 10
No. 1 Northern	0 90	0 04½	0 12½	1 07
No. 2 "	0 88½	0 05	0 12½	1 06
No. 3 "	0 85½	0 05	0 13	1 03½
No. 4 Extra	0 80½	0 06½	0 13½	1 00½
No. 4	0 75	0 08½	0 13½	0 97
No. 5	0 65½	0 09	0 16	0 90½
No. 5 Frosted	0 65½	0 10	0 16	0 91½

In calculating the above figures no allowance has been made for the fact that the straight flour from the lower grades of wheat was of somewhat less value than

that from the higher grades. There may also be some slight errors in assuming that the other mill products are of the same value whatever grade of wheat they have been made from. In studying this table it should not be forgotten that the value of the mill products does not necessarily indicate the value of the wheat to the miller. The cost of running a mill is approximately the same whether each bushel of wheat is yielding products to the value of $1.10 or only to the value of 90 cents. In the latter case the cost of production is relatively greater, and may even be so much greater as to render the poorer wheat quite unprofitable for milling purposes, except at a greatly reduced price. We have also to consider the fact that the demand for low grade flour and other inferior products may be less keen than that for bread-making flour. So that a miller may prefer to pay a relatively higher price for a superior grade of wheat in order to have a large daily output of high grade flour from his mill. Further, the prevailing systems of milling, arranged as they are for good plump wheat, would require some modifications in order to produce the best possible results with inferior wheat, and millers are naturally averse to making such changes. In view of these considerations it cannot be doubted that the value of the lower grades of wheat for milling purposes is distinctly less than the figures given in the above table would seem to indicate.

In regard to the value of the highest grades of wheat, the following quotation from "The Miller" (London, England, Feb. 6th, 1905) is of interest:—

'The English miller does not want No. 1 Hard for making a purely No. 1 Hard wheat flour, but to mix with other sorts in order to make a standard flour of his own, and so long as the No. 1 Canadian wheat is of the very highest milling value it will command a premium over and above its real single milling value.'

No doubt these remarks would also apply to No. 1 Northern and possibly to No. 2 Northern, as well.

It is clear, therefore, that we must always expect the market price of the highest grades to be *higher* and the market price of the lowest grades to be *lower* than the value of the mill products obtained from each would suggest.

AVERAGE PRICES OF THE GRADES IN WINNIPEG.

(Winter of 1904-5.)

Taking the average of several quotations covering the whole of last winter, the following were found to be the average prices per bushel (of 60 lbs.) of the different grades of wheat in Winnipeg:—

No. 1 Northern	96 cents.
No. 2 Northern	93 "
No. 3 Northern	86 "
No. 4 Extra	77 "
No. 4	74 "
No. 5	63 "
Feed	55½ "
No. 2 Feed	52½ "

The quantity of No. 1 Hard offered for sale was so small that it was almost ignored as a factor in the market. In answer to an inquiry, Mr. David Horn kindly furnished the information that the usual price of No. 1 Hard, during the past winter was one cent per bushel above that of No. 1 Northern.

By comparing this list with the previous table it will be seen that the average price of a bushel of wheat is much closer to the total value of the mill products obtainable from it in the case of the higher than in the case of the lower grades. This would indicate that farmers are being insufficiently paid for wheat of the lower grades if the value of the mill products were the only point to be considered in fixing the

price of the wheat. But we have pointed out several important considerations which modify the case. In addition to those already mentioned it should not be forgotten that a scarcity or an abundance of wheat of any particular grade would tend as a rule to raise or lower its price in relation to the other grades. Further, any grades for which there is a special demand will usually command relatively higher prices than the next grades immediately below them. This seems to be illustrated in the above list of prices. The large drop (9 cents) between No. 3 Northern and No. 4 Extra is perhaps due to the fact that many millers refuse to buy wheat of any lower grade than No. 3 Northern; and, again, the still larger gap (11 cents) between No. 4 and No. 5 may indicate that No. 4 is the lowest grade used by any mills.

It is evident that what may be called the *single* milling value of the different grades can never fix the prices that will be paid for the wheat. The highest grades will probably always command enhanced prices, while the value of the lowest grades will be determined by their utility for feeding purposes and not for milling. For some of the intermediate grades, it seems possible that millers could afford to pay relatively higher prices than those which have lately prevailed, if greater attention were given to the grinding of such wheat and special efforts made to find the most advantageous markets for the products.

PART II.

A CHEMICAL STUDY OF THE GRAIN AND FLOUR OF THE GRADES OF WHEAT.

By Frank T. Shutt, M.A., F.I.C.,

Chemist, Dominion Experimental Farms.

The chief object in view in making a chemical examination of the various grades of wheats described in Part I and their resultant flours, was to ascertain what relationship might exist between the composition of a wheat and the quantity and quality of the flour that could be obtained therefrom, when wheats differing in degree rather than in kind were under examination*. It has long been well known that in comparing wheats differing as regards origin or conditions of growth, chemical analysis is of the greatest value in indicating the quality or strength—and to some extent—the quantity of the flours that might be obtained from them. It was, therefore, thought that data from such a series of analyses as have been carried out in this investigation might prove of considerable interest, and possibly of great service when placed side by side with the results from practical milling and baking tests.

It was, further, hoped that from the more detailed analyses of the flours a closer relationship than now exists might be established between the gluten data and the bread-making value of a flour.

The analyses of the wheats were made on the cleaned samples representing the various grades, and referred to on page 5 of this bulletin. The preparation of the samples consisted in grinding the wheat until the whole was reduced to fine powder. For this purpose the two mills commonly employed in the laboratory in grinding fodders and feeding stuffs were employed. The determinations made included moisture, protein, fat, carbo-hydrates, fibre, and ash. The weight of 100 kernels was also taken.

The flours analysed were those obtained in the milling test and designated as 'straight.' (See page 7, Part I). In addition to the estimation of the constituents mentioned in the foregoing paragraph, the proportion of gliadin (one of the constituents of gluten) was determined, a mechanical separation of the gluten made and the relative acidity of the flours ascertained.

COMPOSITION OF THE WHEATS.

Moisture.—All the samples had been kept for some weeks previous to grinding under the same atmospheric conditions. It is not surprising, therefore, to find that the differences in moisture-content are comparatively small and do not call for any extensive comment. It may be pointed out, however, that all the wheats are characterized by a low percentage of moisture—a feature of spring wheats and a matter of consider-

*The wheats inspected and graded at Winnipeg are all of the same hard, spring wheat type (very largely Red Fife) and grown in Manitoba or the North-west Territories. It is evident, therefore, that the differences between these grades are not those which might result from the mixing of wheats of various types (e.g. Spring and Fall) or of wheats grown under widely different conditions of soil and climate.

able importance to the bread-maker, since, other things being equal, the drier the flour the greater the weight of bread that can be made from it.*

There is also another interesting deduction that can be made in this connection, though it is probably not one of great importance. The weight of the kernel in this series is in direct ratio to the plumpness of the grain. By comparing the moisture percentages with the data representing the weight of the kernel it will be observed that the heavier, or, in other words, the plumper, samples contain the larger percentages of moisture. Though the relation throughout the series is not regular, the results generally show that the lighter, and possibly more or less shrivelled, grain is the drier.

Crude Protein.—This is obtained by multiplying the total nitrogen contained in the wheat by the factor 6·25. It is the most important constituent and in wheat consists almost, but not entirely, of gluten—the ingredient which determines the relative 'strength' of the flour and its value for bread-making purposes. Since, however, a part of the protein exists in the bran and in the aleurone layer enclosing the endosperm and which may be separated with the bran, it does not invariably follow that the richer the grain in protein, the stronger the flour, although this is most probably true when comparing wheats of equal plumpness and with equal thickness of bran when milled alike.

The differences in protein-content to be observed between the grades of wheat from No. 1 Hard to No. 5 are very small and the writer doubts if he would be justified in making any deduction of an emphatic nature as to the relative superiority of any one of these grades over another as regards the strength of the flour which they would yield. There is certainly no indication in these crude protein results of a steady decline in strength from the first to the last of the series.

It is a significant fact, however, that the crude protein is perceptibly higher in No. 2 Feed and in No. 5 Frosted than in the grades preceding them, and the writer thinks that this may be accounted for in No. 2 Feed by the smallness of the grain, and hence the larger proportion of bran (which is highly nitrogenous) to endosperm, and in No. 5 Frosted by the shrivelled character of the grain.**

Hence, for grinding as cattle feed these two latter grades are in all probability the most valuable of the series, and following these we should place No. 5 and Feed.

Selected samples of Red Fife, as grown in Manitoba and the North-west Territories, have usually been found richer in protein than these wheats. Thus, in 1893, the writer obtained 14·62 per cent protein as the average for 9 samples grown in Manitoba and 14·53 per cent for a similar number from the North-west Territories. Undoubtedly the character of the season affects the character of the grain, especially as regards protein (gluten), and we may expect from year to year changes of more or less import, both in quantity and quality of this important constituent, but it is evident that the general and mixed character of grade samples should be borne in mind when comparing their analysis with pure, selected grain, or erroneous conclusions may be drawn.

Fat.—Here, also, the results are so uniform—the differences being such as might almost be accounted for in the unavoidable error of experiment—that it would not be safe to discriminate between the wheats, if we except No. 2 Feed and No. 5 Frosted, which, as in protein content, give slightly higher results than the other wheats of the series.

It may be of interest, however, to note that the percentages of fat throughout the whole series are considerably above the average usually quoted for wheats, viz., 1·85. Our former researches, which now include a large number of analyses, have always shown that wheats as grown in the Canadian North-west generally are so characterized and we must consider this as an important and valuable feature from the nutritive standpoint.

---

* These wheats were ground in February. The air in a heated building at Ottawa during the midwinter months is, as a rule, very dry, and this no doubt has had its influence upon the moisture-content of the wheat.

** It has been shown by recent researches in the Experimental Farm laboratories that frosted and rusted grain are in a measure immature, and as a rule characterized by a higher protein—content than similar wheat that has become plump through maturing.

Carbo-hydrates.—These consist, in the case of wheat, mainly of starch, and are found by substracting the sum of the other constituents from 100.

ANALYSES OF WHEATS.

Designation of Samples.	Weight of 100 Kernels.	Moisture.	Crude Protein (N. × 6·25)	Fat.	Carbo-hydrates.	Fibre.	Ash.
	Grammes.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
No. 1 Hard	2·902	10·98	12·56	2·17	70·37	2·45	1·47
No. 1 Northern	2·918	10·63	12·81	2·09	70·62	2·36	1·49
No. 2 "	2·681	10·37	12·69	2·14	70·88	2·39	1·53
No. 3 "	2·465	9·51	12·56	2·25	71·09	2·84	1·75
No. 4 Extra	2·204	8·66	12·43	2·41	72·06	2·73	1·71
No. 4	2·244	9·63	12·25	2·20	71·53	2·71	1·68
No. 5	2·206	8.73	12·81	2·27	71·68	2·71	1·80
Feed	2·160	8·91	12·87	2·39	71·22	2·84	1·77
No. 2 Feed	2 104	9·99	13·06	2 66	69·20	3·25	1·84
No. 5 Frosted	2·337	9·13	13·62	2·42	70·62	2·68	1·53

Fibre and Ash.—It will be noticed that the percentages of these constituents increase, though not regularly, as the weight of the kernel decreases—that is, from the higher to the lower grades. The explanation for this lies in the larger percentage of bran in the smaller (and lighter) grain, and in the fact that the bran coats are the part of the kernel richest in fibre and ash elements. No. 2 Feed illustrates this fact very well; its kernel is the lightest and it contains the highest percentages of fibre and ash.

Weight of the kernel.—The weight of the kernel as ascertained from, say 500 or 1,000 average grains, furnishes important data when comparing among themselves different samples of wheat of the same type. Previous investigation has shown that when such grain is examined there is a very close relationship between this weight and the weight per bushel of the cleaned wheat—the heavier the kernel, as a rule, the larger the weight per bushel and, as may be pointed out, the greater the amount of first grade flour that may be obtained. The present series offers an excellent illustration of this relationship, for with one or two minor exceptions the order of the grades as regards weight of the kernel is that of the weight per bushel and of the amount of 'straight' flour.

WEIGHT OF KERNEL, WEIGHT PER BUSHEL AND YIELD OF FLOUR.

Designation of Samples.	Weight of 100 Kernels.	Weight per Bushel.	Yield of Straight Flour.
	Grammes.	Lbs.	Lbs.
No. 1 Hard	2·902	64	64½
No. 1 Northern	2·918	63½	62
No. 2 "	2·681	62½	61
No. 3 "	2·466	60½	59½
No. 4	2·441	59½	52
No. 5 Frosted	2·337	59	45
No. 4 Extra	2·204	58½	56
No. 5	2·205	57	45
Feed	2·161	56	38
No. 2 Feed	2·105	53½	22

The wheat which offers the chief exception in this consideration is No. 5 Frosted, in which, it is to be observed, that although the ratio between the weight of kernel and weight per bushel is maintained, the yield of 'straight' flour is less than from several wheats of heavier character. The yield of *straight* flour is determined on a colour basis and has in this instance been reduced by the discolouring action of the frost. Examination of the *total* yield of flour for this sample shows that the amount of flour obtainable is directly proportional to the weight of kernel and weight per bushel—and hence, from this standpoint, this wheat falls into line with the rest of the series.

It may be remarked that if these wheats were judged simply by the weight of kernel even the higher grades would be found below rather than above the average as ascertained in our laboratories for first class Red Fife.

COMPOSITION OF THE FLOURS.

The flours submitted to chemical examination in this investigation were obtained in the experimental roller mill and are those designated in Part I of this bulletin as *straight* flours, a definition of which is given on page 6. In addition to the determination of the moisture, protein, fat, fibre, and ash, as in the case of the wheats, the direct estimation of the gluten was made, the proportion of protein in the form of gliadin ascertained and the relative acidity taken.

Moisture.—The percentages of moisture in these flours are considerably less than those in the usual brands of flour upon the market. This is accounted for chiefly by the fact that after milling and before analysis these flours were exposed for some weeks (in small quantities, in bags) when the atmosphere was comparatively speaking, dry. (See note on page 14). This was done for the purpose of equalizing the moisture-content throughout the series and undoubtedly had the effect of drying the flours. The low moisture-content should indicate, other things being equal, high absorptive capacity and a concomitant large bread yield—and this was found to be the case. As the differences, however, between the flours in the percentages of moisture they contain are very small, it would be undesirable to draw any conclusions as to the relative values of the flours in this respect.

Protein or Albuminoids.—As stated in the accompanying table of analyses, the percentage of protein is found by multiplying the percentage of nitrogen in the flour by the factor 5·7. This number has been adopted of recent years as giving more accurately than 6·25 the composition of gluten, of which the protein of flour practically consists.

A study of these data at once shows that it would be practically impossible on this score to discriminate between these flours, the differences in protein-content being so small. It is interesting to note, however, that in this regard No. 1 Hard does not surpass the other grades, indeed it does not stand at the head of the list. As is well known, and as stated in the consideration of the wheats, the protein (gluten) is the most important constituent in determining the bread-making power of a flour. It has been generally held that flours of good quality should contain between 11 and 12 per cent (N x 5·7), but it has been shown by recent analyses in the Farm Laboratories that good bread-making flours may contain considerably less than this amount.

Gliadin.—The water insoluble protein of wheat flour, more commonly known as gluten, has been shown to consist essentially of two albuminoids or proteids, alike as regards their nitrogen-content, but differing in their physical characteristics. They have been named gliadin and glutenin. Gliadin is a glue-like, sticky body and serves to bind and hold together the non-adhesive, non-plastic glutenin (as well as the starch) when the flour is moistened and kneaded and allows the resultant dough to 'rise' under the fermentative action of yeast. It is stated by Osborne and Voorhees, Snyder, Fleurent

and other chemists who have made a special study of gluten and its compounds, that the bread-making value of a flour depends not only upon the amount of gluten present, but also upon the proportion of gliadin to glutenin. Professor Snyder (Minnesota Experiment Station) says: 'Either an excessive or scant amount of gliadin may cause a flour to have poor bread-making qualities.' As regards tentative standards this writer further says that: 'Flour of good quality should contain about 11 per cent protein (N x 5·7) and that from 55 to 65 per cent should be in the form of gliadin.' (Journal

ANALYSES OF FLOURS.

Designation of Samples.	Moisture.	Protein or Albuminoids. (N × 5·7)	Fat.	Carbohydrates.	Fibre.	Ash.
	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
No. 1 Hard	8·53	10·77	1·46	78·83	·43	·58
No. 1 Northern	8·83	11·00	1·58	77·57	·44	·58
No 2 "	8·75	10·77	1·43	78·02	·44	·59
No. 3 "	8·42	11·30	1·57	77·41	·50	·80
No. 4 Extra	8·38	11·17	1·62	77·78	·41	·64
No. 4	8·60	11·00	1·60	78·06	·07	·67
No. 5	8·54	10·89	1·43	78·28	·19	.67
Feed	8·14	11·12	1·95	77·52	·51	.76
No. 2 Feed	8·59	11·34	1·43	77·42	·23	.99
No. 5 Frosted	9·15	11·23	1·49	77·24	·16	.73

Designation of Samples.	Gliadin. (N × 5·7)	Percentage of Protein in the form of Gliadin.	Gluten.			Acidity.
			Wet.	Dry.	Ratio of Dry to Wet.	
	p. c.	p. c.	p. c.	p. c.		p. c.
No. 1 Hard	4·85	45·0	37·56	13·00	2·88	·15
No. 1 Northern	4·90	44·5	39·01	13·48	2·89	·15
No. 2 "	4·85	45·0	35·31	12·64	2·79	·15
No. 3 "	4·73	41·8	36·44	12·81	2·89	·16
No. 4 Extra	4·85	43·4	36·02	12·68	2·84	·15
No. 4	4·85	44·1	36·90	12·61	2·89	·16
No. 5	4·79	43·9	35·86	12·31	2·91	·17
Feed	4·67	41·9	36·40	12·61	2·88	·24
No 2 Feed	4·33	38·1	31·89	11·35	2·80	·41
No. 5 Frosted	4·90	43·6	38·16	13·30	2·87	·22

of American Chemical Society, March, 1904). It would, however, appear from more recent work that there is ample reason to believe that in many good flours the proportion of gliadin is considerably less than here stated. Thus, from bulletin No. 90, Minn. Exp. Stn., issued January, 1905, by Prof. Snyder, in which the analyses of flours are given from 10 standard grades of wheat of 1904 (Minnesota inspection) I obtain, partly by calculation, the following results:

PROTEIN AND GLIADIN IN MINNESOTA FLOURS.

Number.	Designation of Samples.	Protein.	Gliadin, (N. × 5·7).	Percentage of Protein in the form of Gliadin.
		p. c.	p. c.	p. c.
1	No. 1 Northern, inspected in	10·34	5·58	53·9
2	No. 1 " " out	10·60	4·79	45·1
3	No. 2 "	8·57	4·79	55·8
4	No. 3 "	11·10	5·13	46·2
5	No. 4 "	11·08	4·56	41·1
6	Rejected.	11·20	5·01	44·7
7	No grade	11·20	5·24	46·7
8	No. 2 Northern	11·38	4·73	41·5
9	No. 3 "	10·81	4·84	44·7
10	No. 4 "	11·50	5·06	44·0

It will be observed that in only two cases do the percentages of protein in the form of gliadin approach the standard and that in one flour only is the lower limit reached. Eight of the ten samples give percentages practically between 41 and 46.

In answer to a letter of inquiry regarding the gliadin ratio of flours, Professor Snyder writes me, under date of May 20, 1905, as follows: 'As our work on this point extends over a number of years it appears that it is more a question of total gliadin rather than the ratio of gliadin to glutenin. I find that from year to year the gliadin-glutenin ratio varies quite widely, but the total gliadin is a more constant factor and rises and falls with the total gluten, but not regularly. In making nitrogen determinations of the gliadins from wheats grown during different years, I find there is not that constancy that could be desired, suggesting quite considerable changes in the composition of gliadin during different years.'

It should be stated that the method we have followed in the determination of gliadin is essentially that used by Professor Snyder, so that as regards results obtained our data and his should be strictly comparable.*

The percentages of gliadin in the series of flours under investigation are, with the exception of No. 2 Feed, exceedingly close, showing that in respect to this important constituent the flours are extremely uniform. The proportions of protein in the form of gliadin are also (with the exception of No. 2 Feed) close, the differences not being such as to allow any marked inferences being drawn as to the relative values from this standpoint, though it may be pointed out that in this respect No. 3 Northern and Feed appear to be somewhat inferior to the other grades.

It is highly significant that the flour of No. 2 Feed falls considerably below any of the others of this series in the gliadin content, as it also does in wet and dry gluten. Though containing the largest percentage of protein in the series, it would probably be valueless for bread-making, apart from the fact that it is disqualified by colour.

To ascertain how far our data as regards percentage and proportion of gliadin might compare with those obtained from standard brands of flour upon the market, milled largely if not exclusively from North-western wheat, we have analysed 'Five Roses' (Lake of the Woods Milling Co.) and 'Strong Bakers' (The Dowd Milling Co.) and append results.

These results show that the flours of the present series are fairly uniform with those upon the Canadian market at the present time in respect not only as regards protein but also as to gliadin-content and the proportion of this constituent in the protein.

* To five grams of flour in an Erlenmeyer flask, 250 c.c. of 70 per cent (by weight) alcohol were added and the whole agitated at intervals for several hours. After 24 hours the solution of gliadin is separated by filtration and an aliquot portion acidified with sulphuric acid and its alcohol evaporated. The gliadin nitrogen is then determined by the Kjeldahl process.

PROTEIN AND GLIADIN IN 'FIVE ROSES' AND 'STRONG BAKERS' FLOURS.

Designation of Samples.	Protein (N × 5·7.)	Gliadin (N × 5·7.)	Percentage of Protein in the form of Gliadin.
Five Roses.....	10·32	4·56	44·2
Strong Bakers.....	9·92	4·62	46·6

Wet and Dry Gluten.—With respect to these determinations, it may be said that they indicate, approximately, at any rate from the practical standpoint, the relative values of the flours for bread-making purposes, though the character as well as the amount of the gluten is a most important factor in this consideration.

It is generally admitted that the bread yield is dependent largely upon the so-called 'strength' of the flour—that is, the power to absorb and retain water—(a quality that is directly related to the gluten-content). The 'capacity for producing a well risen loaf' which will retain its moisture and elasticity under a crisp crust is rather due to the nature or physical character of the gluten.

The estimation of the gluten is a mechanical rather than a chemical process, and hence the data obtained are in a measure dependent upon the method adopted. We may, therefore, give in outline the process used:

Ten grammes of flour are placed in a porcelain dish, moistened with a sufficient quantity of water and carefully kneaded into a ball. Care is exercised that each particle of the flour has become thoroughly moistened and that none adheres to the sides of the dish. The ball of dough is then allowed to stand for one hour at the end of which time it is transferred to the palm of the hand and there carefully kneaded while a small stream of water is allowed to play on it. The starch is thereby completely eliminated and the operation considered finished when no more turbidity is noticed in the wash water. The ball of gluten having been freed from starch is placed in the porcelain dish, covered with distilled water and allowed to stand for one hour. It is then pressed between the palms of the hands in order to exclude as much water as possible and immediately weighed in a flat bottom platinum dish. The weight obtained multiplied by ten is recorded as wet gluten.

The dish is immediately placed in a water-oven and dried at a temperature approximating 98° C. for forty hours and re-weighed. From this weight the percentage of dry gluten is easily calculated.

Authors usually recommend drying for a period of twenty hours only. It was found, however, that an additional period of twenty hours produced a decrease in weight, thus indicating that the ball of gluten was not completely dry. Periods of desiccation longer than forty hours did not result in any appreciable decrease.

With the exception of No. 2 Feed, the data present great uniformity, including a very close agreement among the flours of the series in bread-making capacity. Mr. A. T. Charron, Assistant Chemist, who made these estimations reports that, with the exception of the gluten from No. 2 Feed, all were firm, elastic and resilient and evidently of excellent quality. The gluten from No. 2 Feed was not soft, flabby and sticky as is usually the case with poor flours, but rather of a pulverulent character, showing lack of cohesion and acting as if there were a deficiency of gliadin. It is of peculiar interest to note, therefore, that it is this sample and this sample only which shows an exceptionally low proportion of protein in the form of gliadin.

Acidity.—The first seven grades have given practically the same figures. These are quite normal for flours from sound wheats, showing that no heating or fermentation of the grain or flour had occurred. In the case of No. 2 Feed there is a well marked rise and it is also of interest to note slightly increased percentages in Feed and No. 5 Frosted.

CONCLUSIONS.

In concluding the discussion on this part of the investigation, we may endeavour to briefly answer the questions: How far does the composition of the wheats as revealed by chemistry agree with the official grading? Can we predict from such wheat analyses the quantity or quality of flour to be obtained therefrom?

We find a great similarity in composition between these wheats, especially among the higher members of the series, as regards all the more important constituents, i.e., those which affect the bread-making quality, and we should presurmise, therefore, that the grading has been based upon the relative yield of first quality flour (of which colour is an important factor) rather than upon the essential differences in what might be termed the relative strengths of the wheats.

As regards quantity of flour, we have shown that in such a series the weight of the kernel and the weight per bushel, and to a minor degree, the fibre, indicate the relative flour yield. Our results in these determinations are in excellent accord, supporting the supposition that the grading of the wheats has been made primarily from the standpoint of yield of first quality flour.

The percentage of protein in the wheat undoubtedly is a measure of the strength of the resultant flour, but if we except No. 2 Feed and No. 5 Frosted we scarcely think it would be justifiable to use differences in protein content such as we have met with between these wheats (frequently less than ·25 per cent), as a basis for the arrangement of the wheats in their order of merit. And the same holds true for the data regarding gluten and gliadin. It is highly significant, therefore, that the resultant flours were found so uniform in quality for bread-making.

Grateful acknowledgment must be made to Mr. A. T. Charron and Mr. H. W. Charlton, Assistant Chemists, for much valuable assistance in carrying out the analytical work of this investigation.

133

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

BACON PIGS IN CANADA

NOTES ON BREEDING, FEEDING AND MANAGING SWINE WITH REPORTS OF SOME EXPERIMENTS

BY

J. H. GRISDALE, B. AGR.
Agriculturist, Central Experimental Farm

BULLETIN No. 51

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

JUNE, 1905

To the Honourable
The Minister of Agriculture.

SIR,—I herewith submit for your approval Bulletin 51 of the Experimental Farm series on the 'Breeding, Feeding, Managing and Housing of Bacon Pigs in Canada' prepared under my direction by Mr. J. H. Grisdale, Agriculturist of the Central Experimental Farm.

The swine industry has developed very rapidly in Canada during the past few years, and the facilities which the country affords for the extension of this profitable branch of farming are practically unlimited.

In this bulletin much information is given regarding the selection of the best types of animals for carrying on this work and different methods of management as to housing, pasturing, &c. Many facts are also presented in reference to the care and treatment of the animals of different ages, and the results of many experiments are given, which have been planned to gain information as to the most profitable methods of feeding swine in the different stages of their growth.

A summary is also presented of the experiments which have been conducted in reference to pork production since the beginning of this work at the experimental farm.

It is hoped that the information given in this bulletin will prove useful to the farmers of Canada, and aid in still further advancing this important industry throughout the Dominion.

I have the honour to be,
Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, June 28, 1905.

PART I.—SOME NOTES ON BREEDING, FEEDING, MANAGING AND HOUSING BACON PIGS IN CANADA.

Geographical position, climatic conditions and foreign market requirements unite to lend an evergrowing importance to the Canadian bacon producing industry. The various problems confronting the farmers who engage in this industry have received at the different Dominion Experimental Farms close attention during the last fifteen years. Some of the information gained is given below and thereto is added a compilation of the results of a number of experiments conducted at Ottawa as well as the results of some work at Nappan, Brandon and Indian Head Farms.

Pigs were introduced upon the Central Experimental Farm in 1890. The breeds invested in were: Berkshires, Improved Large Yorkshires and Essex. Since that time Chester Whites, Poland Chinas, Tamworths and Large Blacks have been added and tested for different periods. The only breeds now kept are Improved Large Yorkshires, Tamworths and Berkshires.

Canadian packers demand pigs of a type suitable for the production of Wiltshire sides. Poland Chinas, Duroc Jerseys, Essex, Large Blacks and in a lesser degree Chester Whites have been found faulty in this respect.

The chief objection offered against these breeds has been the too great proportion of short sided, heavy shouldered, thick fat pigs found among them. Pigs possessing any one of the above peculiarities are not considered suitable for the manufacture of first-class bacon. Pigs having all these characteristics are quite impossible of conversion into prime Wiltshire sides.

THE BACON PIG.

A BRIEF DESCRIPTION.

Bacon hogs ready for the market should possess long deep bodies with straight or slightly arching top and straight underlines.

The shoulders should be fairly upright, joined closely to the body and rounded nicely over the top from side to side. The bodies should not, however, be any thicker through the shoulders at points more than half way up from the underline to the top line than through points at a similar height situated between the shoulder and the ham.

The croup should slope but slightly from the loin to the root of the tail. It should be of good length and should maintain its width throughout, which width should be the same as that of the body and shoulders.

In short, a straight-edge laid against the side from the shoulder point to the tail should touch at every point.

The ribs should spring out well from the spinal column but should fall in fairly vertical lines once their greatest curvature is attained, thus making a deep bodied rather than a round bodied animal.

The body should be carried on good stout, clean, straight-boned legs, free from weakness at the pasterns and with square set hocks.

The feet should be strong and compact, the animal standing right up on his toes.

The neck should be of medium thickness with no tendency to coarseness.

The head should be clean cut and free from flabbiness at the jowl.

SUITABLE BREEDS.

As already suggested, pigs most nearly conforming to these requirements are found in greatest numbers among Large Improved Yorkshires, Tamworths and Berkshires, and among their grades and cross breds.

By 'grade' is meant an animal the product of a pure bred sire, that is a sire registered or eligible for registration in some generally recognized herd book, and from a dam not so registered nor eligible for registration, whether she have none or many crosses of pure bred blood. By 'cross bred' is meant an animal the product of a pure bred sire and from a pure bred dam, the dam being, however, of a different breed from the sire.

Some of the more striking pecularities of these different breeds of pigs suitable for bacon production are given below. These statements are made after several years experience of a varied character with each sort.

LARGE IMPROVED YORKSHIRES, white pigs, have been found to be a prolific and fairly early maturing breed. In shape they come very nearly being ideal bacon pigs. They furnish a very large proportion of carcasses answering the requirements of the best bacon trade. The hams are well developed and the proportion of fat to lean is usually about right.

The sows are docile, good milkers and very prolific. The boars are very impressive, seldom if ever failing to leave a strong impress on their progeny. They are usually robust healthy animals, but are not quite as well suited for pasturing as are pigs from some of the other breeds.

BERKSHIRES, black pigs with more or less white in the face and white points, have shown themselves to be not so prolific as some other breeds but to be very early maturing animals. Their admirers claim for them such a superiority in this respect and in their apparently superior powers to assimilate food as to more than make up for the rather small litters which are not infrequently borne. In conformation they are not quite so well suited for the bacon trade as are some of the other breeds. They are very well suited for pasturing, having few if any equals in this respect and giving very satisfactory returns indeed while being fed in this way. They are quite free from the affections of the skin and other troubles which quite often cause loss with white and red skinned sorts while on pasture.

TAMWORTHS, red pigs, have here shown themselves a quite prolific and fairly early maturing breed. They are almost invariably deep sided and long bodied, but are not infrequently rather light in the ham. They are fairly rapid growers, but are somewhat slower to come to maturity than are some other breeds. They cross well with Berkshires and with the Large Yorkshire. As sires they are fairly impressive.

BREEDING.

To enter into a long discussion of the various considerations that demand the attention of the breeder in his operations would require too great an amount of space for the present publication. The few remarks submitted are intended as a help to the beginner rather than a guide to the initiated.

THE BOAR.

Only pure bred boars of one of the above mentioned breeds should be used where it is desired to produce good bacon pigs. Pure bred sires are more impressive than grades or crosses, on account of having been bred for generations with certain aims in view. That is, pure bred boars are likely to leave litters in which every individual will closely resemble the sire in conformation, while the litters from grade or cross bred boars are likely to vary greatly in conformation.

The boar is half the herd, and where a pure bred boar is used on common or grade sows he is really of still greater importance than all the sows combined so far as conformation is concerned. It is evident therefore that very great care should be observed in the selection of a boar to head even a commonplace herd. All pure bred animals are not necessarily good animals. Many pedigreed pigs now in service should have been castrated in their early days. The very fact that they are pure bred, although inferior specimens, makes them even more dangerous than a common grade scrub, because being pure bred they are much more likely to leave their mark on all their get. Have nothing to do therefore with the pure bred scrub.

The boar to be a good one should in the first place come from good stock. Boars of good conformation are sometimes found among the get of inferior breeding stock. Such boars are not likely to prove satisfactory no matter how nearly they may themselves approach the ideal in conformation and characteristics.

The ideal boar for breeding for bacon production will of course vary somewhat in conformation according to the breed in which he is sought. Generally speaking, however, he should be strongly masculine in appearance but not coarse. Masculinity indicates prepotency or impressiveness. It shows itself in various parts of the animal, more particularly in the head, neck and legs. The head should be of a good size, strong featured and broad between the eyes and ears. It should be attached to the body by a rather short, strong, somewhat crested neck. The hair should be somewhat coarser and the legs somewhat stronger than would be desired in a sow of similar size and the same age. Coarseness in boars is not infrequently mistaken for masculinity, particularly is this the case when the coarseness shows itself strongly in the region of the shoulders. Broad heavy shouldered boars are not necessarily prepotent nor even extraordinarily vigorous sires. On the contrary not infrequently do they prove themselves lacking in vitality and impressiveness. The smooth shouldered, deep chested sire with large heart girth and well let down at the fore flank is much more likely to prove himself a valuable getter than the heavy shouldered fellow with the immense bristling crest so often regarded as the ideal sort.

He should be rather shorter bodied than the ideal bacon pig it is desired to breed and somewhat more compact in form. He should stand right up on the points of the toes of rather short, very strong, clean, straight, well placed legs. The hind quarters or hams and hind legs should be particularly well developed and free from signs of weakness. The croup should be broad, long and carried out fairly straight. Every muscle of the ham should stand well out right down to the hock, both inside and outside the gammon or second thigh. The hocks should be strong and squarely set, and the pasterns particularly well made and set.

The back should be long, broad and straight, save for a slight tendency to arch at the loin. The body should be deep and strong looking.

The visible organs of re-production should be normal and well developed. No. ruptured animals should ever be used for reproductive purposes.

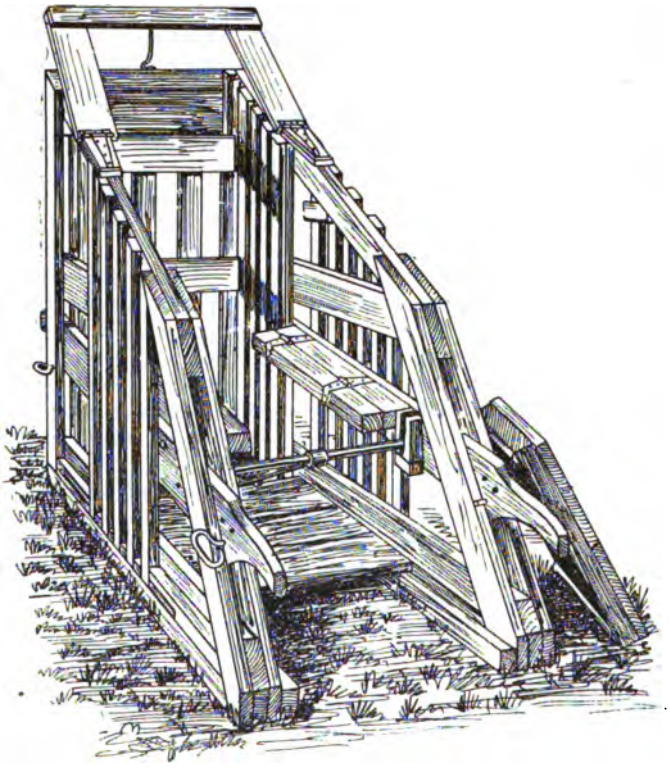
In short the sire should be well balanced, or symmetrical, show lots of vitality and be masculine in his build and appearance.

THE SOW.

Every sow in the herd should be as good as can be procured. Having a good boar will not make up for inferior sows. Where it is not desired to sell stock for breeding purposes, however, the use of pure bred sows is not absolutely necessary to insure success.

It is generally supposed that the good brood sow should be somewhat more rangy, rather more loosely put together and a bit more open in conformation than the good boar of the same breed. Many compactly built sows, have, however, proven very excellent breeders, bearing and raising large, uniform and thrifty litters. It is very easy too to select sows so loose and ungainly as to be quite useless as mothers. In appearance the sow should be essentially feminine. She should have a strong but neat muz-

zle, broad forehead and large eyes set well apart, ears of medium thickness, firm, springy and covered with fine hair. The neck should be of medium length, fairly fine and should show no tendency to arch. The shoulders should be nicely rounded from side to side but a slight tendency to openness here is not so objectionable as in the case of the boar. The chest should be broad and deep and the heart girth very large. The back should be long, broad and arching toward and at the loin rather than straight. Good chest and hind flank are particularly important in the brood sow. They indicate strength and fertility or prolificacy. A good spring of rib and a deep body are also important as indicating fecundity and the likelihood of there being milk for the young when needed.



BREEDING CRATE FOR USE WHERE PIGS TO BE MATED ARE UNEQUAL IN SIZE OR WHERE SOWS ARE DIFFICULT TO SERVE.

The hams or hind quarters should be broad and well fleshed down to the hocks. The hocks should be wide apart but squarely set. This peculiarity together with a broad rump indicates ease in farrowing, which is a quite important consideration. The sow should stand on good, strong, clean boned, upright pasterned legs. Coarseness is not desired in bone or conformation, but any tendency toward what might be correctly described as fineness of bone cannot be too strongly condemned. It means sterility or small litters, weak pigs, and unprofitable operations.

No sow possessing less than twelve teats should ever be retained as a breeding animal. If she show fourteen or fifteen good teats starting well forward near the fore legs so much the better.

The teats should be evenly distributed and each should have a well defined udder for itself. A careful examination of teats should be made to see that all are milk giving and not blind, nor small secondary teats situated close to large useful ones.

Blind teats or teats having no opening will yield no milk, small or secondary teats situated close to good ones are very little better than blind teats.

In looking for animals conforming as nearly as possible to the above requirements no attention should be paid to individuals from small, uneven or badly nourished litters. Prolificacy or fecundity is hereditary, likewise the throwing of even litters and the power to yield a plenteous supply of milk for the nourishment of the young. Not infrequently good litters are spoiled because of the poor milking qualities of the mother. This quality of a good sow should receive much more attention than is usually given to it, and attention thereto in making the selection of the sow would most certainly be rewarded by the peculiar thrift and vigor of the litters from the good milking sows.

In conclusion let the sows selected be docile. An irritable nervous animal is sure to prove unsatisfactory for breeding purposes. Young pigs do not always betray this peculiarity even though they possess it in a high degree hence the character of the mother should be noted in this respect. Of course very much may be done by care and training or lack thereof to make or mar both sexes in this respect. Kindness in dealing with live stock of all kinds is necessary; in dealing with no class will it prove more profitable than when bestowed upon brood sows and boars.

STARTING A HERD.

To the would-be beginner not learned in hog lore nor wise by experience, one or two additional suggestions might be offered.

The first selection of sows should be made from a herd showing uniformity of type, provided, of course, such type fairly closely approaches the ideal. It is much less difficult to judge of the probable value of a pig for breeding purposes at nine months old or older than it is at any earlier age. Hence the safer and quite probably the more economical plan for the beginner would be to purchase young sows safe in young. In addition to the points already discussed on preceding pages the buyer should see that the sows were well grown for their age and closely resembled each other in characteristics and conformation. If establishing a pure bred herd is aimed at it will be found that no other distinguishing peculiarity will be of so great value and such a valuable advertisement as uniformity of type in the whole herd. The stock boar or boars need not, and in fact, had better not be purchased at the same time as the sows. A study of the sows and their litters for a few months having in mind the sire or sires of the various litters will prove a wonderful help toward the selection of a good animal to head the herd. He should be chosen in conformity with the type described above but any weakness of the sows should be kept in mind, and a boar particularly good where the sows are weak will be found of value in correcting these faults otherwise likely to be transmitted to the offspring. Occasionally where no serious faults are in evidence and where it is particularly desired to fix more firmly some good quality or establish a type, pigs fairly near akin may be mated. It is unsafe, however, to make more than one cross with closely related sires and generally speaking animals less than three generations apart should not be mated.

CARE AND MANAGEMENT.

BREEDING.

The sow should give her first litter when about a year old. If bred to farrow at an earlier age, she is not likely to raise such a good litter; if allowed to go much over that age she is adding to the cost of production quite unnecessarily. First litter pigs are supposed to be inferior to pigs from subsequent litters but our experience here does not appear to support this idea. It will of course be necessary to have no more pigs on the sow than she can properly nourish, and to feed her exceedingly well while suckling the young.

It is usually better to allow somewhat more than six months between the first and second litter. For that reason, if it is possible to keep the sow in fair condition the first litter had better be allowed to run with her for three months or longer. In this way she will be prevented from coming into heat. Sows if allowed to come into heat once or twice without being served are very frequently quite difficult to get safe in young when it is finally decided to breed them. Sows giving only one litter a year are usually unsatisfactory breeders for the above reason, and although fall litters may not be so profitable as spring litters, the breeder anxious to have his spring litters at a certain time, or desirous of making the most money possible out of his feeding operations would most likely find it more satisfactory and profitable in the long run to have two litters in the year.

FEEDING.

Before being bred and during the early weeks of pregnancy a succulent ration, pasture in summer and roots in winter, will be found the most satisfactory and economical. Rape, clover, blue grass, brome, alfalfa, vetches or pease and oats all make excellent pasturage, and but a small amount of meal will be required in addition until the sow is ten or twelve weeks gone in young when the addition of a small amount of chopped oats or barley, bran, shorts or whole pease will be advisable. In winter, pasture may be replaced to a large extent by roots, &c., as sugar beets, mangels, turnips, kohl rabi, cabbage, carrots, ensilage, clover or alfalfa hay dry or steamed. The chief considerations are to keep the sow in good flesh by means of flesh forming rather than fat forming foods to let her have lots of exercise and to keep her digestive organs in nice condition. Keep the sow in good flesh, half starved breeding sows are certain to give inferior young, but by all means avoid getting them too fat. Over fat sows are likely to have small weakly litters.

FARROWING TIME.

For a week or ten days before farrowing or parturition which should occur about 112 days after service, the sow should receive a rather more liberal ration of milk producing food such as bran mashes, chopped oats, skim milk, shorts, a little oil meal, &c., being careful always to see that there are no signs of constipation, that the bowels are quite loose.

The attendant should always be on good terms with every sow, but this should very particularly be the case for a few weeks before, during the time of, and for a few weeks after parturition. By a little petting and a few kindnesses that appeal to her sense of what is nice the attendant can win the confidence of almost any sow, provided of course, that he has not previously won her dislike.

Parturition should take place in a pen specially prepared for the event and for the accommodation of the mother and her new family during the first few weeks of their lives. Only a small amount of cut straw or chaff should be given for bedding, thus no opportunity being offered the little ones to get lost or tangled up and so exposed to danger of death from cold, hunger or crushing by the sow. As a further protection, a board, about 8 inches wide placed flat horizontally about 8 inches from the floor along the wall to which it should be firmly attached will be found of considerable value, affording a space where the little ones can run or be shoved when the mother lies down.

Generally speaking, the less interference at parturition the better. If the weather be cold, a good plan is to have some clean dry straw in a box or barrel into which the little ones may be placed as they are born being first dried with a cloth. If parturition is slow in cold weather it is sometimes wise to put some warm bricks or flat stones in the box with the youngsters. They should be allowed to suck as soon as possible after birth.

Shortly after birth any sharp teeth in the mouths of the young ones should be broken out by means of a pair of small pinchers. This will usually be found to help materially in smoothing out little family difficulties.

The sow will not likely show any desire for food within 24 hours after farrowing; but should she show any disposition to eat, a warm thin mash or gruel of bran, shorts or oatmeal may be given. No cold drinks should be allowed within the 24 hours, but frequently small amounts of warm water may be given. Her ration as soon as she is in good shape to utilize the food should consist of bran, shorts, ground oats and barley, pease, oil meal, skim milk, &c., and some roots or green feed. She will require a very heavy and very nutritious ration after the second week, but the closest attention must be paid to the young to see that the milk is agreeing with them. Any signs of scours or constipation should be the signal for a change in the feed of the sow. The character of the food eaten by the sow seems to influence the quality of the milk she produces and so affect the digestive organs of the little ones. The health of the litter is an accurate gauge of the healthfulness of the dam, and *vice versa*. It is of course possible to feed so as to cause the sow to produce too much milk and so make the piglings too fat. This condition not infrequently shows itself in what is known as 'thumps,' a disease nearly always fatal.

WEANING.

The little ones should be encouraged to eat at as early an age as possible. The fencing off of a part of the pen in such a way as to make it possible for the young ones to get into the enclosure, but impossible for the sow, and placing therein a flat shallow trough containing sweet new whole milk will be found of great value in this connection. The most scrupulous cleanliness must be observed, however, or serious digestive troubles are likely to result. In a short time skim milk may be gradually substituted and to this the addition of a mixture of equal parts of very finely ground oats or oatmeal, shorts, corn meal and oil meal will be found to give very satisfactory results.

Care must be taken to feed only small amounts of these foods at a time, but they may advantageously be fed as frequently as four or five times a day. If not on pasture some green feed, some sods, some roots or better still all three should be given them from time to time.

Pigs so fed will be practically weaned by the time they are eight weeks old or even sooner. In spite of every effort to anticipate the dangers of weaning time it is usually a rather critical period. Plenty of exercise, frequent feeds in small quantities of the above mentioned feeds and protection from wet and cold will, however, usually prove effective in getting them well started.

When it is decided to wean entirely, the feed should be gradually taken off the sow. She will on that account begin to give less milk and at the end of a week will be nearly dry, when she should be taken away out of sight and hearing of her young.

CARE OF THE BOAR.

The boar is usually able to serve sows when 5 or 6 months old. He should not be required to do so before he is 8 months of age, and should be used on but few sows even then. The amount of service that he may do will depend upon his development and condition. Careful watch should be kept to see that he is not losing in flesh on account of service performed. Young boars should never serve more than one sow a day, nor should they be expected to do that much for many days in succession. Mature boars may serve two in the day, and keep on at that rate for a considerable length of time if conditions are in every way favourable.

The boar should be kept apart from the sows in heat saving the time necessary to give one complete service. This service should, if practicable, be given when the oestrum or heat is nearly over. Service under such conditions is more likely to be effective than if given at the beginning of heat. Where animals of unequal size are

mated a breeding crate as per illustration will be found useful. To insure the boar keeping in good service condition he should have plenty of exercise. To permit this a good roomy pen or a large yard must be provided. In summer he should have at least a small pasture wherein to roam and root at will. Not infrequently returns of sows to service are due to the lethargic condition of the boar rather than to the sterility of the sows. Plenty of exercise, with the right kind of food, will almost entirely overcome this condition. The boar should be fed sufficient food to keep him growing rapidly, and in good flesh if young, and in good flesh in any case. He should not, however, be fed such foods as are likely to make him fat, but rather flesh and bone-forming foods. Ground oats, pease and barley, shorts, bran, oil meal, skim milk, &c., in varying proportions will be found to give good results. The addition of a considerable amount of roots or other succulent foods to the meal ration is very advisable, in fact almost imperative in winter or when no pasture is provided. Mangels or sugar beets will be found to be the most satisfactory for the purpose, although turnips, cabbage or kohl rabi will do.

FEEDING.

PASTURES AND PASTURING.

Under average Canadian conditions it will be found practicable and quite advantageous to give every pig intended for bacon production from 3 to 4 months on pasture. It goes without saying that every breeding pig should spend practically the whole warm or moderately warm part of the year out of doors. The advantages are various. In the first place, it will, in the case of breeding pigs, be found to be by far the most economical way of summering, while feeding pigs will be found to be very materially benefited in as much as they seem to be able to make better use of grain or meal fed them after the pasture period. The gains made while on pasture are not likely to be very rapid nor particularly economical, but the digestive powers seem to be improved, and the frame well developed.

It has been found advisable to have an area rather large in proportion to the number of swine to be pastured. This area should be divided into at least three parts, and a three-year rotation followed thereon. In following a rotation there are various advantages:—(1) A variety of crops may be grown, a very considerable improvement over the one crop plan. (2) The pigs may be changed over from one part to another, so not fouling the pastures so rapidly. (3) Advantage may be taken of the increased fertility of the pastured plots to take a crop of grain or roots every third year.

A rotation followed here that has been found very satisfactory is as follows:—1st year, rape and roots of various kinds, some of which are harvested and the balance pastured off. 2nd year, grain seeded down with various mixtures of clovers and grasses. The grain is used for soiling cattle or harvested when ripe according to the season and the condition of the crop. Great care is taken to see that the grain does not fall and so smother the grass and clover plants. It is cut on the first sign of falling. The various mixtures of grass and clover are pastured to a limited extent in the fall. 3rd year, The field is divided into small runs according to the kind of grass and clover, and the class of pigs. The plots pastured off first are, if necessary, ploughed up and sown to rape or pease, oats and vetches for pasture later in the season.

By following this rotation good pastures are available from early in May till the snow falls.

PREPARATIONS FOR PASTURING.

Before starting in to pasture pigs at all extensively some preparation must be made.

Fences.—Good pig-proof fences must surround the whole area. Probably the cheapest fence for this purpose will be found to be woven wire. A board fence is very effective, but lacks durability and is expensive. Barb wire fencing can hardly be made to turn small pigs. A good plan is to have a woven wire fence 2 or 3 feet high and two or

three strands of barbed wire above the same to turn the larger pigs. In addition some portable fencing should be on hand for dividing the large fields into plots. Wooden hurdles may be used and are fairly economical. Wooden framed wire netting hurdles are also very effective. Woven wire stretched tightly on very firmly set posts one at each end of the proposed division line with stakes at intervals is probably as cheap and easily handled a moveable fence as any. (See illustrations.)

Cabins.—Portable sleeping houses that may be easily moved from one plot to another are necessary and may be constructed at small expense. A good size is 8 feet square or 8 feet long by 6 feet wide. The side sills should be of good stout scantling 6 inches x 4 inches, and the floor of 2-inch plank nailed thereto. The upper part may have two forms, that is the roof part may come right down to the sills (see cut) or may rest on side walls about 2 or 2½ feet high. For sows with young the sort where the roof starts at the sill is somewhat to be preferred.

Feeding Appliances.—Where the pastures are any considerable distance from the feed room it will frequently be found advisable to have a portable feed cabin on wheels or runners. Where it is not desired to go to such an expense as building a portable feed cabin, a barrel on wheels may be fixed up quite cheaply. (See cut for both of these).

PORTABLE FEED ROOM AND FEED BARREL ON WHEELS.

An excellent trough for outdoor feeding is described below. A trough 4 feet long will allow 6 pigs to eat in comfort, 3 on each side. For such a 4 foot trough secure:

1 two inch plank 1 foot wide, 4 feet long.
2 two inch plank 6 inches wide, 4 feet 4 inches long.
2 two inch plank 1 foot wide, 20 inches long.
3 inch boards 6 inches wide, 4 feet long.

The largest plank will constitute the bottom, the two short planks the ends and the two long narrow planks the sides of a flat bottomed trough. Two of the 6 inch wide boards should be nailed between the end pieces near the top in such a way as to make a V-shaped trough, save that they should not come together at the bottom by about 3 inches. The other 1 inch board should be nailed one edge up in a vertical position between the two ends. The upper edge should be about 1 inch below the open bottom of the false V-shaped trough and the lower edge about 4 inches from the bottom of the

trough. The purpose of the false upper trough is to allow the feeder to pour the feed into the trough even though the pigs are struggling to get at the food.

Such a trough is easily kept clean, easily filled in spite of crowding pigs, strong and durable.

PASTURE CROPS.

Rape.—As a green feed for soiling that is cutting and feeding green, or for pasture, rape stands unequalled, among crops suitable for swine. It should be sown in rows two feet apart on stubble, fallow or well rotted sod at the rate of three pounds per acre. It may be sown any time as long as there remains six weeks of growing weather before severe frosts are to be expected. If intended to be pastured the pigs should be turned in before the rape comes up to the top of their shoulders. No greater area should be given than they are likely to keep down to that height or lower. If not pastured or cut too close to the ground it will keep on growing as long as the growing season lasts. Greater returns may be expected from soiling than from pasturing a given area. Feeding pigs will generally make more rapid gains when it is being fed to them in moderate quantities in pens than when at pasture on it. Breeding stock are likely to do better when they are allowed to use it as pasture. Feeding pigs receiving all the rape they will eat or on rape pasture should receive somewhat less meal than they would if in their pens. From one-third to five-sixths of the regular meal ration should be fed, the more rapid the gains desired of course the heavier the meal ration.

Mature sows not in young require very little other food when on rape pasture. Young sows and sows in young need to receive at least half the normal meal ration.

Vetches.—A crop remarkably palatable to pigs and one that gives a fairly good return per acre is the common black vetch. It is very little if any superior to pease, however, and the seed is usually more expensive.

Hairy Vetches make a very good green feed for swine but the seed is exceedingly expensive and a large amount is required per acre. It has, however, not infrequently stood through the winter here and so might be utilized for an early spring pasture. Like rape it will grow up again if not too closely pastured or clipped.

Oats and Pease.—These two sorts of grain mixed in equal parts by weight and sown at the rate of three bushels per acre furnish a pasture or soiling crop that gives very good returns per acre. Either sown alone is fairly satisfactory but not nearly so valuable as the combination.

Soja Beans.—A fairly palatable soiling crop high in feeding value has been produced by sowing Soja beans at the rate of 40 pounds per acre in rows about 20 inches apart. They have never been pastured here and would most likely not prove very satisfactory for feeding in that way. The green varieties are the best and should be sown in the latter part of May.

Red Clover.—Sown with grain and allowed to get a good start in the fall, red clover may be expected to yield a palatable and abundant supply of forage or pasture for pigs in May and June. If pastured off it will be found necessary to ring the pigs. Sows on clover require but very little other food.

Alfalfa.—On well drained soil in good heart and tilth in almost all parts of Canada, alfalfa may be expected to grow well and to furnish a most excellent and abundant supply of pasturage. It seems peculiarly well fitted for swine but should not be pastured too severely for fear of damaging the roots. The superiority of this crop over most other forage crops for swine or other stock is such as to much more than make up for the slightly greater cost of seeding down. If cut early and well cured pigs eat it freely in the form of hay.

Artichokes.—This crop has been tried here several times and given very satisfactory returns indeed for the outlay. The artichokes should be planted much as are potatoes early in the spring. The crop is not usually ready for use till about the end of September. The best method of using them is to turn the pigs right into the lot and let them root. Frost does not injure the artichokes and any roots left in the ground may be pastured off the next spring or left as seed for another crop. The most economical and rapid gains ever recorded at this farm were made with pigs pastured on artichokes and receiving a fairly liberal meal ration. They are somewhat superior to potatoes. The chief objections to the crop are the difficulty in securing seed and the rather short period during which they may be fed. They may be harvested and fed in winter but the harvesting is an expensive operation.

Roots.—Mangels, carrots or turnips may be used as pasture in October or earlier. They are probably quite as economical when so fed off as though fed to pigs in pens.

ROOTS AND GREEN FEEDS FOR WINTER FEEDING.

Just as pasture or soiling crops are valuable in summer, so are roots or some form of succulent feed almost indispensable in winter where successful bacon production operations are to be carried on. These feeds are valuable not only on account of economy, but also because of the good effect they have upon the health and digestion of the animals fed. Many experiments have been conducted here to gain some information as to the best green feeds for winter, as to their value compared with grain or meal, as to the best way to feed them, and as to the quantity to feed to get the best results. In a general way it may be stated that our experiments rank succulent feeds available for winter in the following order according to palatability, and value as flesh producers : Artrichokes, potatoes, sugar beets, mangels, carrots, turnips, small apples, pumpkins, kohl rabi, cabbage and ensilage. According to the method of preparation and the kind of succulent feed, 100 pounds of mixed meal is worth from 500 to 700 or 800 pounds or even more of the succulent feed.

Some of these green feeds may be fed best one way, and some in other ways, as indicated below, and generally speaking from 3 to 4 pounds of succulent feed to 1 pound of meal gives the most economical gains of the best quality of meat.

Apples.—Refuse apples of all kinds have been fed to pigs here in large quantities. They are not particularly valuable as a feed for fattening pigs, but seem to do very well along with a small quantity of meal for dry brood sows.

Cabbage.—Generally speaking, cabbage are too expensive to feed to swine, but occasionally they are available and seem to be quite palatable. Some feeders report them to be rather constipating than laxative in effect.

Carrots.—These roots have been fed here to a limited extent for pork production. They are not quite so palatable as are mangels and sugar beets. They do not keep so well in winter as do most other roots, hence are not to be very highly recommended.

Clover Leaves.—Clover leaves and small stems gathered from the unloading floor in haying time, stored in sacks and steamed in winter or at any time, make a most excellent drink and feed for swine of any age. Such a drink seems as valuable and quite as palatable as skim milk. Especially is this the case if it be fed warm.

Ensilage.—Corn, clover, alfalfa, corn and clover, and alfalfa and corn ensilage have all been fed here to a greater or less extent. Ensilage containing clover or alfalfa has invariably proven welcome to swine, while pure corn ensilage also has been eaten fairly well. The addition of some dry meal to the ensilage causes it to be eaten quite readily.

Kohl Rabi.—This plant has been fed here to a limited extent only, but has proven a fairly welcome feed to swine of all classes.

Mangels.—For sows and general feeding Long Red or Gate Post mangels are difficult to improve upon. They are exceedingly palatable, may be fed in large quantities, do not need to be pulped, and are better suited for the requirements of sows carrying young, and for growing pigs than are sugar beets or any other sort of green feed we have tried. They should not be cooked. Other varieties of mangels are also useful, but apparently not so welcome to the pigs as are the Long Reds. We have fed as high as 25 pounds a day of these roots to dry sows or to sows not far advanced in pregnancy. As the period of pregnancy advances, however, it will be found advisable to decrease the roots and slightly increase the meal ration.

Potatoes.—These tubers fed alone raw scarcely suffice to sustain life in pigs, but cooked and a moderate amount of meal, 20 pounds of meal to 100 pounds of potatoes, mixed with them, they make a most excellent feed for fatting pigs, and produce a very fair quality of bacon. Potatoes in small quantities fed raw, help to keep pigs in health where other succulent feed is lacking.

Pumpkins.—To get the greatest returns from this fruit it must be cooked. Boiled in double its weight of water and half as great a weight of meal as of pumpkin added it will be found to furnish a most appetizing and fatting feed. The quality of meat so produced here has been very good. Rapid gains may be anticipated with a slight tendency to over development of fat.

Sugar Beets.—Sugar beets are easily the most palatable of the different sorts of roots that have been fed here. They may be fed to greatest advantage by pulping them. From 3 to 6 pounds a day per 100 pounds live weight according to rate of gain desired has been found to give best results. The meat produced on this feed has always proven of a superior quality. They do not need to be cooked. They are not so suitable for young pigs, brood sows and breeding stock generally as are some of the other roots, mangels and turnips for instance.

The Sugar Mangel, a root half way between the sugar beet and the mangel, has been fed extensively here with very good results. It has, however, not proven quite so good as mangels for breeding pigs. If only one kind of root can be grown it is possibly the best that could be chosen.

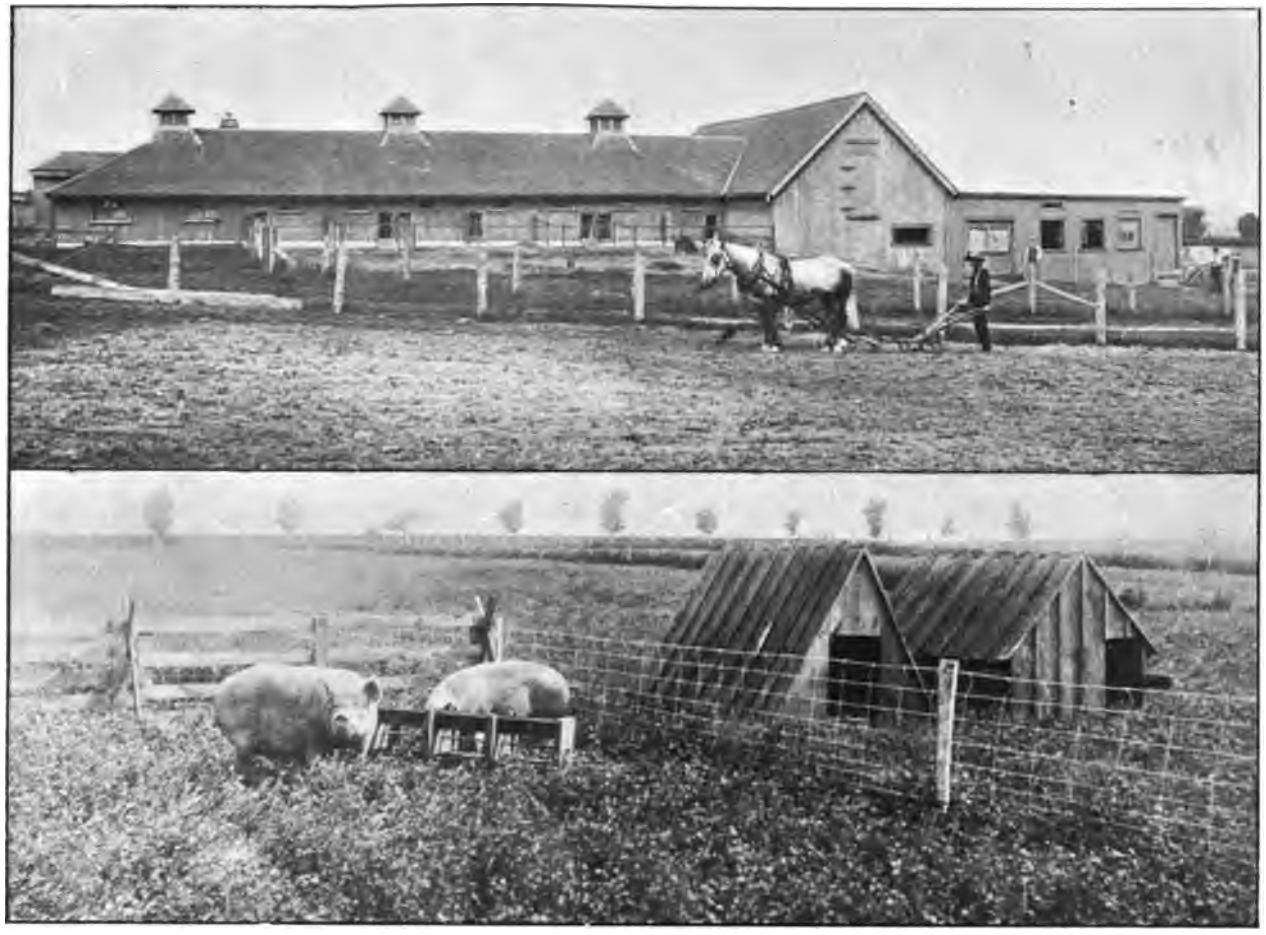
Thousand Headed Kale.—This plant, which resembles rape, has, like the latter, proven valuable as a feed for swine, but is not likely to be found quite so useful. It should not be sown quite so thickly as rape, as it makes a somewhat stronger growth.

Turnips.—Where other roots have not been fed, turnips will prove quite palatable and give very satisfactory returns. They do not seem at all to the liking of pigs that have been getting sugar beets or mangels. They may be fed cooked, when they seem to give somewhat better returns and are much more welcome to the pigs. If for sows, they may be pulped and mixed with the dry meal in the proportion of about 10 of meal to 100 of roots. Fed in this way they are a very valuable food.

PREPARATION OF FEED.

Much will be said incidentally in discussing the various feeds as to the best method of preparing each. A few general remarks *re* our findings in this matter will, however, probably be of some value.

Into the preparation of grains for feeding to swine, various considerations enter. Briefly expressed they are:—cooked *versus* raw; warm *versus* cold; ground *versus* whole; wet *versus* dry; soaked *versus* dry; thin *versus* thick slop.



1.—Piggery at Central Experimental Farm, Winter quarters for Sows at right-hand end.
2.—Cut showing Sows in Alfalfa pasture, two styles of cabins, two styles of movable fence and a handy movable trough.

In the preparation of roots, the considerations are whole *versus* pulped; raw *versus* cooked; and alone *versus* mixing with meal.

Cooked versus *Raw.*—Many experiments go to prove that raw grains are just as valuable if not even more valuable than cooked grain for swine.

Warm versus *Cold.*—There is no doubt that feeding warm feed once or twice a day in cold weather is a decided help to the thrift and health of pigs. Particularly is this true if the pigs are young and in rather cold quarters. Warming must not be taken to mean cooking.

Ground versus *Whole.*—Almost all grains should be ground for swine. This is more imperative in the case of oats, pease and barley than for most other grain feeds. Soaking for 36 to 48 hours before feeding makes up for lack of grinding to a certain extent. Grinding is particularly imperative where very young pigs are being fed.

Wet versus *Dry.*—Meal fed dry is probably more perfectly digested than similar meal fed wet. Soaking meal for 24 to 36 hours turns the table in favour of the wet. The objection to dry feeding is that the pigs scatter and lose more or less on the floor.

Thin versus *Thick Slop.*—For fattening pigs, a thick slop is undoubtedly to be preferred. For pigs on pasture or breeding stock, a thin or dilute slop is more suitable as they are better satisfied when through eating, even though a light ration has been fed.

Roots.—It is usually better to feed green or succulent feed whole and apart from the meal. Where the roots have to be pulped, however, as is the case with sugar beets and turnips, dry meal may be mixed with the pulped mass and prove very satisfactory. Roots or succulent feeds need, with one or two exceptions, never be cooked. Potatoes, turnips and pumpkins, however, are more valuable cooked than raw.

SOFT PORK.

At factories where many pigs are slaughtered and cooled daily, there are usually to be found among the carcasses a number that are described as 'soft' or 'tender.' In these carcasses the fat and sometimes the lean meat is found to be more or less yielding to pressure, somewhat greasy to the touch and the whole side not infrequently limp and flabby. From such carcasses only a very inferior class of bacon can be produced, and they must therefore be sold at considerable loss. The proportion of soft or tender sides varies greatly according to season and district from which the hogs come. A study of the matter has revealed various causes as affecting the quality of the meat. Not to enter too minutely into a discussion of the different experiments or the results obtained it may be stated in a general way that the influences or conditions affecting the quality of meat so far as firmness or softness are concerned are as follows:—

1. *The Kind of Feed.*—Certain kinds of feed seem to affect the firmness of the meat by supplying elements of a character likely to render the fat soft. Of such feeds, corn is probably the most largely fed and has probably a greater quantity of 'Soft Pork' to its credit than any other feed. Rye is another feed that has not proven satisfactory in this respect. An excess of green crop or pasture is likely to prove injurious. Beans also have proven to be productive of soft pork, in fact, all pigs fed on beans here yielded very soft sides.

2. *Method of Feeding.*—Many feeds if given in proper proportions to other feeds in the ration are not at all injurious, although exceedingly objectionable if fed exclusively or in too great quantities. Under this class come corn, rye, pasture and some sorts of roots. An exclusive meal ration not infrequently leaves soft sides even though

the meal be varied and of the kinds best suited for firm pork production. On the other hand certain feeds seem to overcome the injurious effects of other feeds and a first class quality of meat is produced in spite of the fairly large use of the otherwise injurious feeds. In this class rank skim milk, whey and roots of some kinds.

3. *The Thrift of the Animal during the Feeding Period.*—Pigs that have come along steadily at the rate of say 1 pound per day from birth are not so likely to give soft pork as are others on the same feed that have suffered from indigestion or that have been set back in any way. Unthrifty pigs are almost certain to yield soft pork.

4. *Rate of Growth or Length of Time Required to Reach a Given Weight.*—Pigs fed too rapidly are likely to produce an inferior class of pork, both soft and too thick, while pigs fed too slowly not infrequently produce soft meat, particularly is this true if they are brought to the block a little on the thin or unfinished side. Unfinished pigs, old or young, quite frequently yield soft or tender sides.

5. *Health and Method of Feeding Immediately Before Slaughtering.*—Pigs unhealthy, in heat, or suffering from any check in growth at time of slaughtering are likely to leave soft carcasses.

NOTES ON GRAINS AND MEALS.

BARLEY.

In Europe barley is looked upon as the ideal feed for fatting and finishing off bacon hogs. In Canada most experimental work goes to support this view. So favourably is it known in fact that it has practically become a standard by which other foods are judged so far as their value for bacon production is concerned. It should be fed ground. Soaking for 24 hours or longer before feeding will in part make up for lack of grinding. It is not a very good feed for sows suckling their young, nor for very young pigs. It may be fed alone to advantage, but will give somewhat better results if ground pease, shorts or oil meal in small quantities or well ground oats be added. It makes a prime quality of bacon wherever other conditions permit.

BEANS.

Beans may be fed whole, ground, raw or steamed, but are most commonly fed steamed or cooked. They produce a very inferior quality of bacon when making up the larger part of the ration.

BLOOD MEAL.

Prepared by drying and powdering the blood in slaughter houses, blood meal is very rich in flesh-forming material, and has generally given good results so far as economy of gains, quality and firmness of bacon are concerned. It must be fed in very small quantities and as part of a ration otherwise low in flesh-forming material, such as corn. It has been used to some extent as a substitute for skim milk, in which capacity it has proven fairly valuable.

BRAN.

Save for fairly large pigs and breeding stock, bran is not a very valuable feed. It is too coarse and too difficult to digest. It produces a good quality of meat, however, and is a useful food for sows carrying their litters, or suckling their young.

BUCKWHEAT.

Buckwheat has been fed quite extensively to swine in some parts of Canada, and has given good results. It may be fed alone, but does better if mixed with barley, oats

or corn. It gives from a rather poor to good quality of bacon according to conditions under which fed.

CITY REFUSE.

The refuse from hotel kitchens, &c., has been fed extensively by many feeders. It has been found valuable for stockers and dry brood sows, but is not to be recommended as a feed for the finishing off period. It is claimed to have an injurious effect upon the quality of meat.

CLOVER HAY.

Clover hay, cut a little on the early side, or the leaves which fall off while unloading, makes a capital feed for young pigs and breeding stock. The tea made by steeping such hay in boiling water has shown itself to be nearly as valuable as skim milk for young pigs.

CORN.

Packers generally condemn the use of corn for pork production. Extensive experiments here have shown it to be a fruitful cause of soft pork where fed in any considerable quantities. It is, however, a very economical feed for pork production and may be fed to a considerable extent if mixed with other feeds.

It should be ground and mixed with oats, pease, barley, shorts or bran to insure a fair quality of bacon. Fed at the rate of about one pound of corn to two of skim-milk it may be expected to give very cheap and very rapid gains and to produce a very fair quality of bacon. Without skim-milk or whey it is practically certain to have an injurious effect upon the firmness of the bacon as well as to seriously modify the desired proportion of lean to fat meat. The meals the most suitable to mix with it are pea, oat and barley, shorts and bran also may be used to advantage.

Pumpkins or roots steamed fed along with it give very rapid gains.

CORN AND COB MEAL.

Corn and cob meal has generally proven too coarse and harsh for young pigs but may be used to some extent for mature or fairly large pigs. It has not been fed here but other feeding stations report favourably so far as economy of gains is concerned. It is not likely to prove advantageous to bacon producers, since many of the objections offered against corn are equally applicable here.

FROZEN WHEAT.

Some years ago frozen wheat was available in considerable quantities and was fed quite extensively. It was found to be very valuable as a feed for bacon production. The meat was of good quality and was produced at the rate of one pound live weight for from 4½ to 5½ pounds of the frozen wheat. It is rendered somewhat more palatable and slightly more useful by the admixture of crushed oats, ground barley, bran or shorts.

GLUTEN.

Gluten has been fed in limited quantities, but has not proven very satisfactory for either bacon production, young pigs or breeding stock. It seems to be rather unpalatable and produces soft bacon.

OATS.

Grinding is essential in order to get the greatest returns from oats. It is an excellent feed for boars and sows when soaked for some time before feeding. To be

fed to young pigs the hulls must be sifted out or the whole mass ground ver yfine. The addition of corn meal and oil meal in equal parts say one pound of each to three pounds of oats constitute an excellent ration for stock of any age. Small or frozen wheat and oats (about equal parts) ground together make excellent feed for pigs of any age. They produce a good to excellent quality of bacon.

OAT FEEDS.

A number of bye products from oat meal mills and other cereal food factories bearing the names of Oat Dust, Oat Feed, Meal Seeds, &c., contain usually a very large proportion of fibre to digestible material. They vary greatly in composition and should not be purchased for pig feeding without a guarantee of their real food value being given.

OIL MEAL.

Of all the meals available for pig feeding, oil meal is probably the most valuable for sows suckling their young and for the young after weaning if fed in moderation. It should never exceed twenty per cent or one fifth of the whole ration. It may, to a large extent, be used as a substitute for skim-milk. It is not to be recommended as a finishing off feed for bacon hogs.

PEASE.

'Canadian Pea Fed Bacon,' so extensively advertised in Great Britain, would appear to indicate the superior value of this much sought after farm product for bacon production, and it is undoubtedly of very high value as a feed for the production of good firm bacon. It also stands high as a feed for young pigs and breeding stock of all classes at practically all times. It should, however, never be fed alone, and further, the pease should always be ground. The most suitable feeds for mixing along with the pea meal are ground oats, barley, corn, bran or shorts. Pigs fed on pea meal alone do not thrive, do not get fat, and produce a very inferior quality of meat, hard and dry.

PEA FEEDS.

Pea feeds under various names are bye-products of prepared food factories, and vary in composition. Some of them are quite equal to pea meal in feeding value, while others are of comparatively small value. They are, however, in most cases excellent feeds for supplementing the average cereal ration or for feeding to young growing stock.

RYE.

Rye has not been fed very extensively for pork production Canada, but experiments appear to indicate a value somewhat similar to, though not quite so high, as for wheat. It should be fed in conjunction with some other somewhat more bulky food, as ground oats and barley. It produces a fair to good quality of bacon, when judiciously fed.

SHORTS.

Shorts, although as a rule much superior to bran for pigs, is not infrequently so coarse or contains so much fibre as to be very little better than bran for young pigs. Good shorts, however, that is shorts containing a fairly liberal admixture of white material is certainly a most excellent feed for pigs of all classes. It is, under such conditions, one of the very best single feeds for young ones just weaned. A slight admixture of oil meal improves it.

SKIM MILK.

According to findings in Europe and America about 600 pounds of skim milk equal 100 pounds of mixed meal for pork production. The value of skim milk in terms of the amount of meal it equals is a very variable quantity. The kind of meal, the relative weights of meal and skim milk, and the condition of the milk fed all influence results very markedly. Probably the best proportions between the two would be 3 of milk to 1 of meal. The meal along with which it is likely to give the best results is corn. It should be fed warm and sweet. If impossible to feed sweet and warm at all times it should always be fed sour and cold. Uniformity in quality, quantity and temperature at all times adds very materially to the net value of a given amount fed in a given period of time.

SLAUGHTER HOUSE REFUSE.

This class of feed, like city refuse, may be used to advantage for breeding stock and stockers, but has, it is claimed, an injurious effect upon the quality of the meat produced when fed to fatting pigs.

SPELTZ.

This cereal has been fed to only a limited extent in Canada, but has proven fairly satisfactory so far as economy of pork production is concerned. It seems to be nearly as valuable as mixed grains pound for pound.

SPIRIT GRAINS.

Spirit grains fed here to a limited extent have, so far as economy of gain is concerned, proven very valuable for bacon production. They should be fed along with corn or barley, when they will be found particularly useful.

STOCK FOODS.

Various stock foods have been tried here to a limited extent, but have proven neither profitable nor satisfactory. Similar experiments conducted in England and in different state experiment stations in the United States have given similar results.

TANKAGE.

This bye-product of the meat packing houses has not been fed to any considerable extent here, but seemed fairly satisfactory when ever used. It must be fed in small quantities, and will take the place of skim milk to a certain extent as a factor in the quick and economical production of pork.

WEED SEEDS.

The weed seeds and the small wheat from elevators have been fed quite extensively, with good results from an economical standpoint. Of the various weed seeds commonly found in grain that of the pig weed (*Chenopodium Album*) is the most common, and has been fed to advantage by many farmers as well as by experimental feeders. Not much is known as to the quality of the meat produced by these seeds.

WHEAT.

As a single feed for pork production wheat stands near the top of the list. It is a most excellent feed for young and old, comparing very favourably with pease in its value for pork production. It may, however, as is not the case with

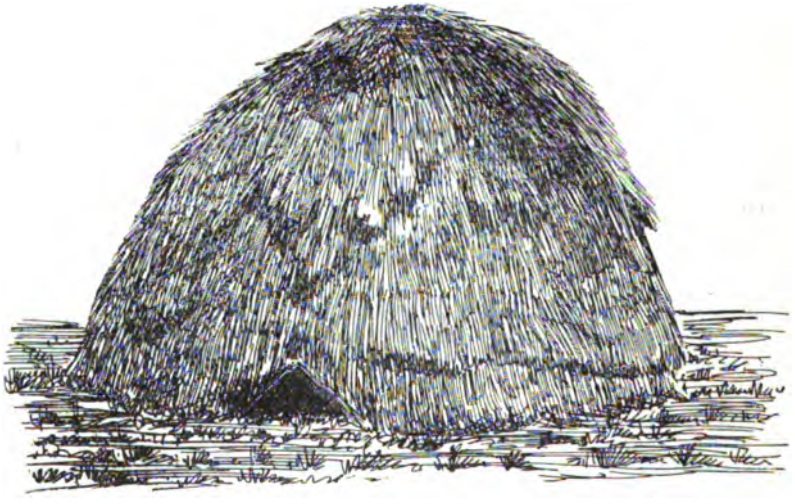
pease, constitute the exclusive meal ration of swine at almost any age, and may be expected to produce a fair to excellent quality of bacon at a rather small outlay in pounds of grain for pounds of gain live weight. It should be fed ground or well soaked. The addition of crushed oats, barley or corn to the wheat will materially decrease the amount of food required for one hundred pounds gain.

WHEY.

Whey is supposed to be worth about half as much pound for pound as skim milk. It has a very good effect upon the quality of the bacon produced. The portion fed daily should be uniform in quantity, quality and temperature. Sour whey is quite as good as sweet whey, provided it has not been soured more than 24 hours, and has been kept in a clean vat.

WHOLE MILK.

Whole milk is too expensive a food to use in large quantities. It is, however, about the best food known for pork production. If for very young pigs, a small amount fed warm may be used to advantage. Very young pigs entirely dependent on fresh whole cow's milk should get very rich milk (containing from 6 to 8 per cent of fat), to which a small amount of sugar should be added.



A WINTER PIG-PEN IN MANITOBA.

HOUSING.

METHODS.

In summer, as already indicated, portable cabins are likely to prove the most satisfactory sort of pig house. Experiments conducted here with various sorts of pigs of different ages go to show that under average Canadian winter conditions wintering in such cabins is an unprofitable plan.

CHEAP WINTER QUARTERS.

Sows may be wintered in much colder quarters than feeding pigs. A large well lighted room, as shown in the floor plan, has been found very satisfactory. A glance at the photo of the piggery at the Central Experimental Farm, Ottawa, on page will show such a building at the far end.

In Manitoba, Mr. S. A. Bedford, Superintendent of the Experimental Farm, reports very good results from wintering sows and breeding stock generally in a pen made by constructing a low framework of poles on posts, with a similarly constructed passage leading out of it on the south side, and then covering the whole structure with a large amount of straw (see cut, page 22). The writer saw pigs come out of such a pen in 30 degrees below zero weather, eat their dinners and retire apparently happy and evidently in perfect health.

REQUIREMENTS OF A GOOD PIGGERY.

Light.—Every perfectly satisfactory piggery for winter use must be well lighted from the south, east or west. If from all three directions, so much the better. Direct sunlight rather than diffused light is what is required to insure health and aid in sanitation.

Warmth.—Warmth is another important feature of the satisfactory piggery. Walls such as described below will, other conditions being favourable, prove sufficiently non-conductive. Warmth must never be secured at the expense of pure air. If it is impossible to ventilate properly and maintain a sufficiently high temperature with the natural heat of animals, it might be found advantageous to use artificial heat. In any case, pure air is more to be sought than a high temperature in winter quarters.

Freedom from Moisture.—Freedom from moisture on the walls and ceilings is another important requirement. This may be insured by proper construction of walls and ceiling and by perfect ventilation. The walls and ceiling should be built with a dead air space. This space should have building paper on both sides of it. That is, a wall, starting from the outside, should consist of matched inch lumber, tar paper, studding tar paper, matched inch lumber. A similar construction should be called for in the ceiling.

Material.—Another factor affecting the freedom of a piggery from moisture is the material used in construction of walls and floor. Wood, although not very durable, is quite likely the best suited for the walls. Cement blocks, or hollow cement walls are likewise said to be very satisfactory. Wooden floors are a constant source of annoyance on account of the quickness with which they wear out and the practical impossibility of keeping them clean. Cement floors are said to be too damp, but a cement feeding floor, with a good tight wood floored sleeping room is likely to prove satisfactory.

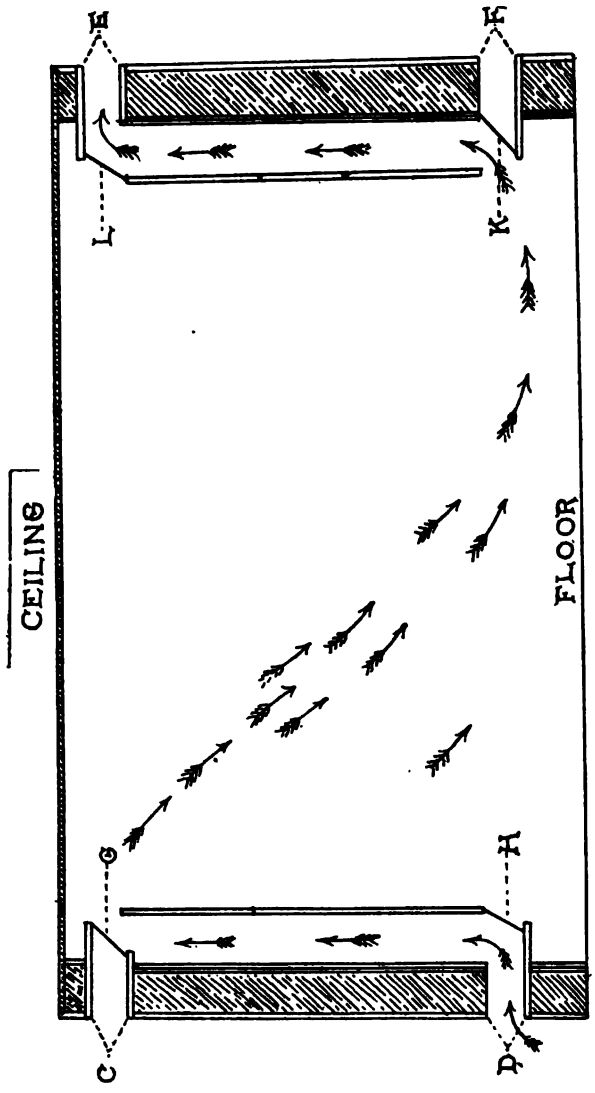
Ventilation.—A sufficient and effective system of ventilation is another very important requirement of a good piggery. The air should be admitted in such a way as not to allow the cold air to come in direct contact with the pigs, and the foul air had better be removed from near the floor. If the wall plan or roof plan is not such as to admit of the introduction of the system described and illustrated on page 24, some other simple plan may be devised. Ventilation arrangements must not be neglected, however, and an outlet alone is not a perfect system.

A SYSTEM OF VENTILATION.

The system outlined is one of several that have been tried in the stables at the Central Experimental Farm, during the last eight or ten years, and is the one that has given the best satisfaction wherever tried.

Described in a general way it may be said to consist of a number of hollow shafts or tubes placed inside the stable in contact with or close to the walls. These hollow shafts start about one foot or eighteen inches from the floor and extend vertically upward to within 3 or 6 inches of the ceiling. At the top and bottom, these shafts turn at right angles and traverse the wall. They are also open to the air, that is, inside or out-

side air, that shall flow through these shafts is controlled by means of dampers at the top and bottom as described below.



CROSS SECTION SHOWING SYSTEM OF VENTILATION.

The number and size of these ventilating shafts will of course depend upon the size of the piggery and the number of swine therein. There should, if possible, be one or more on each outside wall. The total area of the openings through the walls at the bottom should show about 3 square inches per animal housed in the pen. To illustrate, a piggery holding 30 head of swine should have 4 ventilators each 2 x 10 or 6 ventilators 2 x 6½ or 8 each 2 x 6 inches inside measurement. The large area required is on account of half or more of the ventilators having to serve as outlets, as will be seen later, because while those ventilators on the side or sides which the wind strikes serve as inlets the ventilators on the opposite side serve as outlets.

In above diagram ventilators are shown on opposite walls and the swinging parts or doors set to allow air to enter by way of D and G from the left and leave the pen

by way of K and E through the shaft on the right entering it at the bottom K and going up and out at E, as indicated by arrows.

On the left, the trap or door H is set so as to prevent any air entering the stable or going out at that point, while G is set to prevent any air entering or leaving the room at opening C. The same may be said of doors L and K.

The doors are placed in these positions when the wind is coming from the left side, but when the wind happens to strike the right hand side of the stable then the position of all the ventilators should be reversed and the air should enter by way of F and L and leave by way of H and C. The ends of the ventilators should not project from the walls on the outside.

The trap doors may be constructed of wood or sheet zinc and may be controlled by means of a projecting handle or by means of cords.

By letting the upper doors hang vertically some of the warmer air near the ceiling may be drawn off if the temperature become too high.

If the wall be built as described on page 23, the space between two studs may be used in the place of the shaft shown, and so nothing but the inlets and outlets show. Under such conditions the doors would have to be hung in the middle of the wall and would be somewhat more difficult to manipulate.

THE FLOOR PLAN.

A frequently neglected feature in building piggeries is the providing of convenient passages for cleaning, bedding and moving pigs from pen to pen. A study of the floor plan of a piggery on page 26 will show one way of laying out pens to insure convenience in all these matters.

EXPLANATION OF FLOOR PLAN.

The floor submitted on page 26 is not given as being the ideal, since no plan could possibly be the best for every feeder. It includes several ideas, however, which could be incorporated into almost any plan of a piggery, and these ideas can be best expressed by giving the diagram included.

The building may, of course, be of any necessary length to accommodate from 20 to 100 pigs or more. Two rows of pens flank the passage, one on either side.

Doors two feet wide open off the passage into each pen. The feeding is done from the passage, and for a discussion and exemplification of methods see pages 16 and 17.

The pens are 10 feet front and 12 feet deep, being large enough for from 4 to 8 animals according to size.

In the plan FL, FL, FL are feeding floors 6 x 10.

L, L, L.—Low partitions separating the beds from feeding floors.

D, D, D.—Large swinging doors or partitions, 6 feet long and 4 feet high, serving as partitions between pens when at right angles to the passage, and serving to confine pigs in bed space when parallel to passage.

When D, D, D, are all parallel to passage, a truck or barrow may be run along FL, and the pens easily cleaned.

Tr, Tr, Tr.—Troughs made of cement or hardwood and iron trimmed.

Dr, Dr, Dr.—Doors opening into yards; d, d, d, are doors from pens to passage.

K, K, K.—Posts against which D, D, D close.

B. C.—Breeding crate. (See illustration, page 8.)

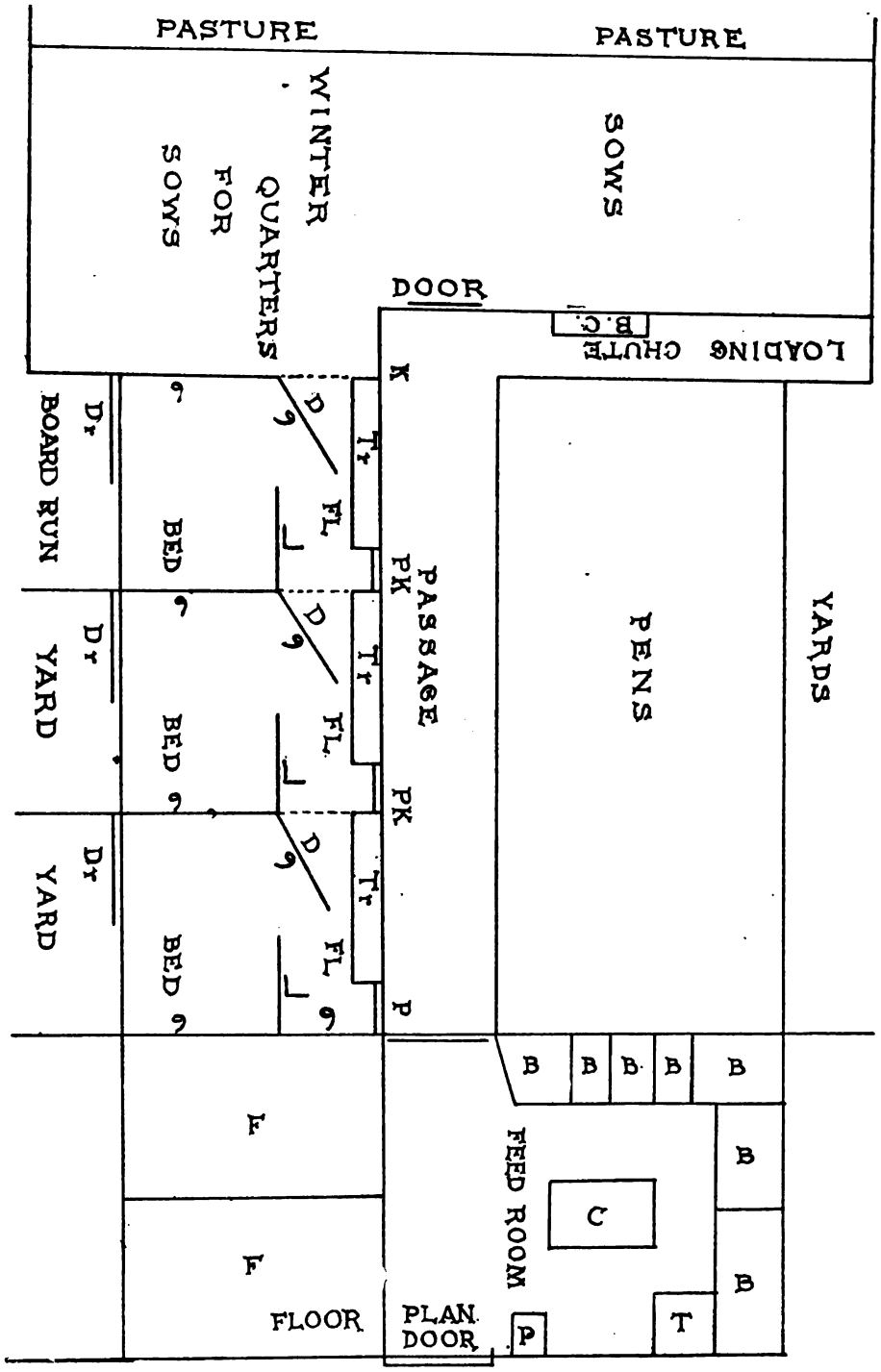
F. F.—Farrowing pens fitted up as described on page 10. In the feed room the cooker or heater C occupies a somewhat central position.

B. B. B., &c.—Bins for feed.

P.—Pulper.

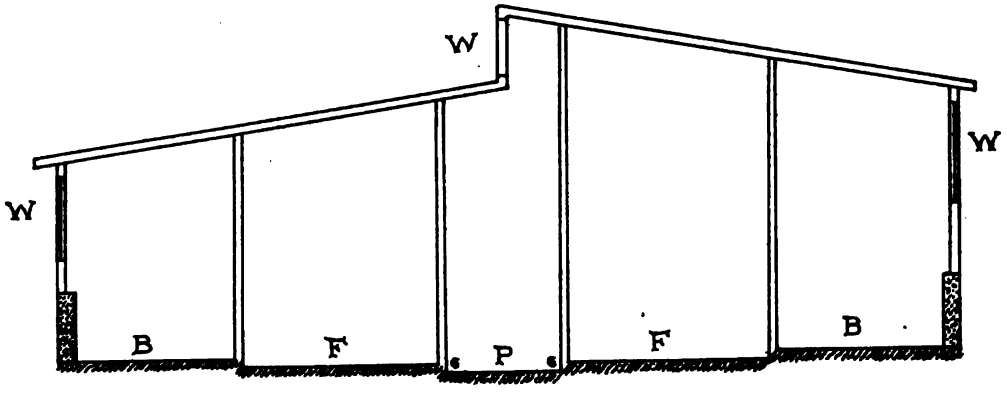
T.—Trap-door to root cellar.

The feed room floor should be of cement, supported by railroad iron.


PASTURE
PASTURE
WINTER QUARTERS FOR SOWS
SOWS
DOOR
B.C.
LOADING CHUTE
K
Dr
BOARD RUN
D
Tr
FL
BED
PK
PASSAGE
PENS
YARDS
Dr
YARD
D
Tr
FL
BED
PK
Dr
YARD
D
Tr
FL
BED
P
B
B
B
B
B
F
FEED ROOM
C
B
F
B
FLOOR
PLAN DOOR
P
T

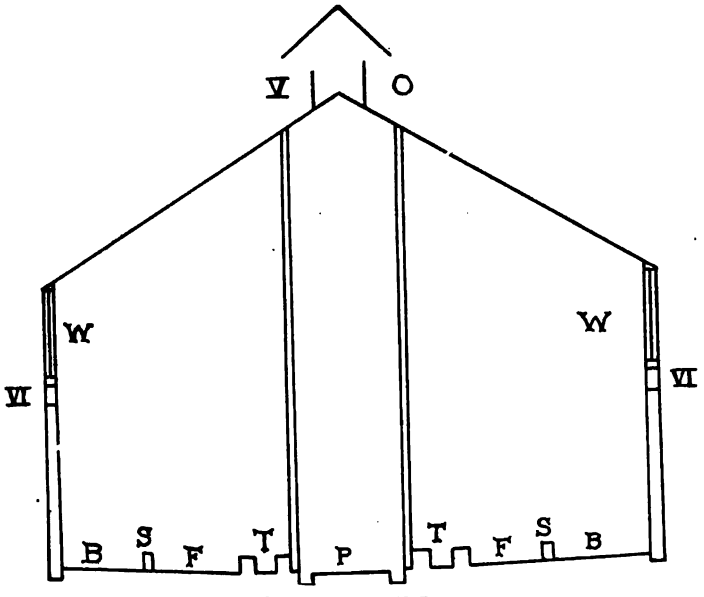
FLOORS.

A glance at the floor lines in cross sections A., B., C., D. and E., will prove more instructive than any word picture. In cross section A. the floors slope toward the passage P. B. is the bed, 3 inches above the feed floor F. F., feed floor, with slight slope towards passage P. T., cement trough. G. G., gutters along passage.



CROSS SECTION A.

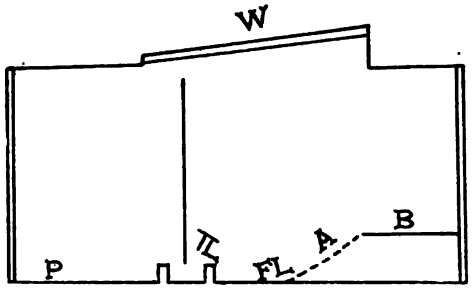
In cross section B., B. is the bed. S. is a 4 x 4 inch scantling or cement straw guard around the bed. F. is the feed floor with slope toward the passage P. Along P. run two gutters for carrying off liquid manure.



CROSS SECTION B.

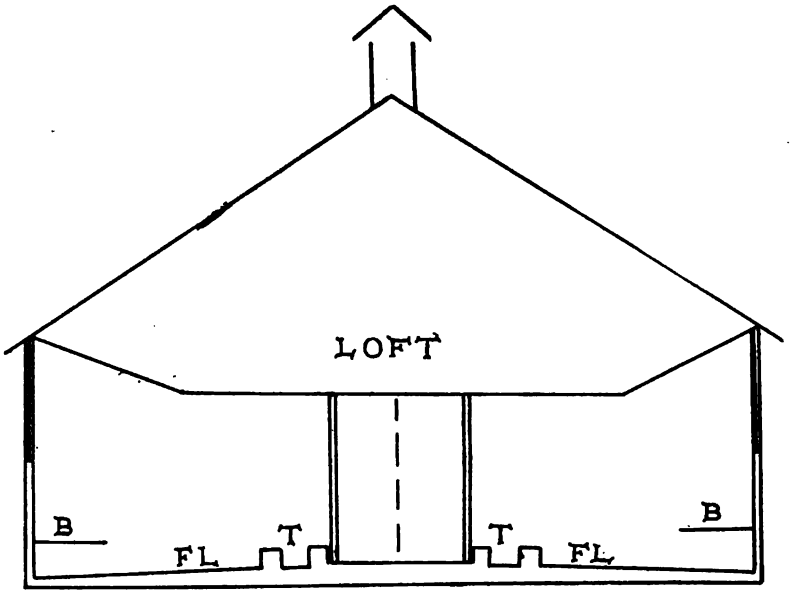
In cross section C., P. is the passage T. L., the trough part of which is in the cement passage, permitting the placing of the feed in the trough without any moving of the front partition, as shown in cut on page 29.

F. L. is the feed floor sloping away from the trough. B. is the elevated bed 2 to 3 feet high, reached by means of approach indicated by dotted line A.



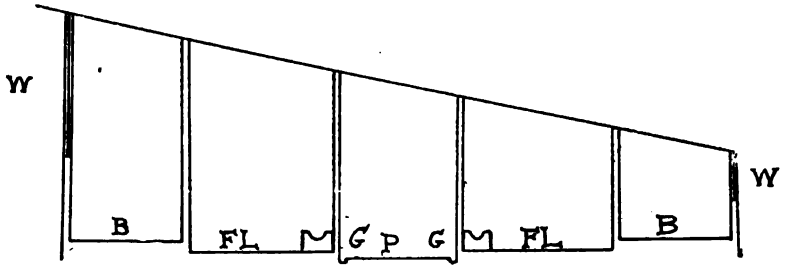
CROSS SECTION C.

In cross section D. the floor falls away from the trough and from one side to a hole down through the floor in one corner of each pen. B. B. are elevated beds.



CROSS SECTION D.

In cross section E the floor plan is the same as in B.



CROSS SECTION E.

II

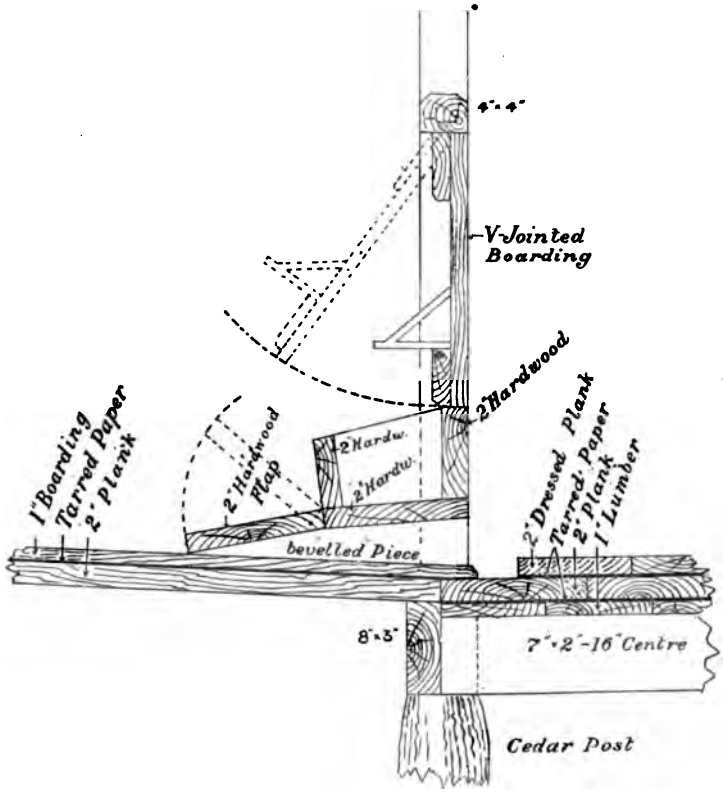


DIAGRAM SHOWING METHODS OF FEEDING PIGS AND DRAINING PENS.

NOTE.—In the figure the details of the placing of the feeding trough, the hinged foot board in front of the trough and the swing door for convenience in feeding are all shown.

The construction of the pen floor with slope to gutter in passage floor may be seen on right.

The fall in the floor towards the feeding-trough permits the swine to lie on a dry bed at the back of each pen.

The absence of air space under pens makes for greater warmth. Therein lies one of the great advantages of the cement floor.

DRAINAGE.

Drainage is one of the prime necessities of a good piggery. The pen floors should be built to slope either to or from the passage, 2 inches in the 12 ft. will be found to be ample pitch. If it slopes to the passage a small drain will be necessary down each side of the passage. If it slopes from the passage a drain all along the back of the pens and under the beds will be necessary. The better plan is usually where it slopes to the passage, and runs along it to some underground drain.

PARTITIONS.

The question of partitions is of considerable importance. For the dividing partitions in pens there seems to be no doubt that wood is the most satisfactory material. For the partitions next the passage it is just possible that wire may have some advantages. Very strong wire well stayed by numerous strong uprights must be used. Wire partitions are of value in making a pen light and airy, but are a disadvantage in leaving the pigs more exposed to draughts which often cause serious troubles.

FEED ROOM.

The feed room should be provided with a heater if much winter feeding is to be carried on. Around the walls should be feed bins and a small root pulper should find a place on the floor. Under the feed room should be a root cellar, and over it a loft for storing straw with a chute leading therefrom into the passage.

THE ROOF.

Many and various are the styles of wall and roof that are advocated. Some of the best may be understood by again referring to diagrams A, B, C, D and E.

The roof plan, lighting and ventilation are so closely related that they should be considered at one and the same time.

In section B, the roof is a common half pitch, and the windows are placed as high as the eaves will allow on both sides and as low as safe from pigs. Such a building should run north and south. V.O. is the foul air outlet at the top, and V.I. on either side the fresh air inlets. These latter openings may be closed by a species of trap door controlled by a string reaching to the passage. V.O. also may be opened by means of a swinging trap.

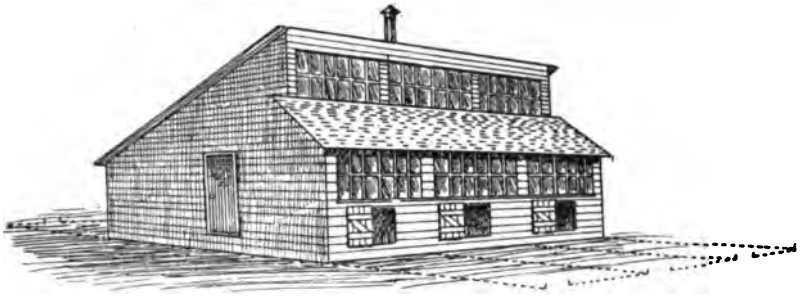
The style of roof shown in section A is one that has met with considerable favour in many parts of America. The two parts of the roof should have the same pitch and be of the same length. The wall on one side should be three or four feet higher than on the other side, so that there may be a drop of three or four feet between the higher and the lower parts of the roof at the centre of the building. Such a building should be built to have the upper window face the south. Windows are indicated by W.W.W. on each side and in the centre of the building in the drop between the parts of the roof. The centre window may be on hinges and could then be manipulated by means of a rope or other appliance to let foul air out. Fresh air may be admitted as per plan outlined under B, or as per plan in diagram, page 24.

A line drawing of such a piggery as the above is shown in illustration, page 31.

Cross-section C is that of a flat roofed building with the light admitted from the top only. The window should have a slight slope toward the south. The best method to ventilate such a building will be the system outlined on page 24.

In diagram D, a plan for a building with a loft is given. This roof and ceiling plan admits of a great deal of light entering the piggery without having the whole ceiling so high as to render the building cold. The upper part of the window being hinged permits of it being worked to act as a ventilator for both inlet and outlet. Windows are indicated by triple lines.

In plan E a single slope roof is shown. Piggeries built on this plan should have pens with a proportionately larger frontage on passage so as to decrease width of piggery. The south or large window should be at least six feet high.



A SMALL PIGGERY.

PART II.—A COMPILATION OF A NUMBER OF EXPERIMENTS IN PIG FEEDING CONDUCTED AT THE CENTRAL EXPERIMENTAL FARM INCLUDING A FEW CARRIED ON AT NAPPAN, N.S., BRANDON, MAN., AND INDIAN HEAD, ASSA.

COMPARISON OF BREEDS AS TO ECONOMY OF GAIN.

Because pigs of some breeds show a tendency to lay on fat rather than produce muscle or lean meat, many farmers suppose that they fatten or mature rapidly and lay on flesh more cheaply. Such is not the case. Many experiments conducted here and elsewhere show very little difference in economy of gains with animals of the different breeds.

The following tables show the quantities of feed consumed per pound of increase in live weight, by swine of different breeds or breeding during different feeding tests.

Table I. shows the quantities of frosted wheat, ground and soaked in cold water for an average period of eighteen hours, consumed by swine of different breeding per pound of increase in live weight. They were fed for a period of twelve weeks.

TABLE I.

No. of Swine.	Breeding.	Date of Birth.	Average of live weight per head.		Feed consumed per lb. of increase.
		1892.	Oct. 3.	Dec. 26.	
			lbs.	lbs.	lbs.
3 Crossbreds ..	Berkshire sire and Poland-China dam..... ..	May 14.	109	210	5·03
4 Grades.....	Improved Large Yorkshire sire and Berkshire Grade dam.....	June 13.	94	186	5·03
2 Crossbreds ..	Improved Large Yorkshire sire and Berkshire dam..	May 1.	128	213	5·56
3 Purebreds..	Improved Large Yorkshire	Aug. 4.	91	157	5·87

Table II shows the quantity of a mixture of equal parts by weight of barley and frosted wheat both ground and soaked in cold water for a average period of thirty hours, plus pulped carrots, consumed by swine of different breeding per pound of increase in live weight. They were fed for a period of twelve weeks.

TABLE II.

No. of Swine.	Breeding.	Date of Birth.	Average of live weight per head.		Feed consumed per lb. of increase.	
		1892.	Feb. 7 or 14.	May 2 or 9.	Grain.	Carrots.
			lbs.	lbs.	lbs.	lbs.
6 Crossbreds ..	Improved Large Yorkshire sire and Essex dam	Sept. 23.	70	134	3·77	0·76
3 Purebreds...	Berkshire	" 24.	117	186	4·17	0·76
4 Crossbreds ..	Improved Large Yorkshire sire and Poland-China dam	Aug. 3.	119	189	4·42	0·89
4 Purebreds...	Tamworth	" 30.	114	172	4·74	0·86
4 " ...	Improved Large Yorkshire	2, May 17 / 2 Aug. 4	189	236	5·83	1·06

Table III. shows the quantity of a mixture composed of equal parts by measure of barley, rye, frosted wheat (all ground) and wheat bran, soaked in cold water for an average period of 8 to 18 hours, consumed per pound of increase in live weight by swine of different breeding. Some of them were fed for a period of fifteen weeks, and some of them for a period of twelve weeks.

TABLE III.

No. of Swine.	Breeding.	Date of Birth.	Average of live weight per head.		Feed consumed per lb. of increase.
		1893.	Aug. 23.	Dec. 6.	
			lbs.	lbs.	lbs.
5 Crossbreds ..	Improved Large Yorkshire sire and Berkshire dam..	June 9.	42	86	3·62
5 " ..	Berkshire sire and Improved Large Yorkshire dam..	" 6.	49	108	3·72
5 " ..	Essex sire and Improved Large Yorkshire dam.....	May 31.	45	98	3·73
2 " ..	Berkshire sire and Tamworth dam	" 7.	94	173	4·03
5 " ..	Berkshire sire and Poland China dam	Apl. 27.	83	161	4·11
5 " ..	Essex sire and Improved Large Yorkshire dam....	May 31.	41	83	4·27
			Sept. 6.	Nov. 29.	
4 Grades.....	Tamworth sire and Berkshire grade dam.	July 3.	52	113	3·24
5 Purebreds...	Improved Large Yorkshire.....	June 15.	48	82	3 90

Table IV. shows the quantity of a mixture of equal parts by measure of barley, rye, frosted wheat (all ground) and wheat bran, soaked in cold water for an average period of eighteen hours, plus 3 pounds of skim milk per head per day, consumed per pound of increase in live weight by swine of different breeding. Some of them were fed for a period of 8 weeks and some for a period of 12 weeks.

TABLE IV.

No. of Swine.	Breeding.	Date of Birth.	Average of live weight per head.		Feed consumed per lb. of increase.	
		1893.	Dec. 6.		Meal.	Milk.
			lbs.	lbs.	lbs.	bls.
Crossbreds..	Improved Large Yorkshire sire, and Berkshire dam.....	June 9.	86	Jan. 31. 150	2·52	2·56
5 Purebreds...	Improved Large Yorkshire.	" 15.	82	Feb. 28, 191	2·64	2·31
5 Crossbreds..	Essex sire and Improved Large Yorkshire dam..... ....,.....	May 31.	98	Jan. 31, 169	2·88	2·32
4 Grades.....	Tamworth sire, and Berkshire grade da ..	July 3.	117	" 31, 202	3·10	1·95
5 Crossbreds..	Berkshire sire, and Improved Large Yorkshire dam....	June 6.	108	Feb. 28, 223	3·09	2 17
5 " .	Essex sire, and Improved Large Yorkshire dam...	May 31.	83	" 28, 192	3·23	2·53
2 " .	Berkshire sire, and Tamworth dam.....	" 7.	173	" 28, 225	3·77	2·45

Conclusions.—From these four series of tests it appears that:—

1. The breeding of the swine which gave the largest increase per pound of feed consumed was different in each of the four tests, viz.:

Table I.—Crossbreds, Berkshire sire and Poland China dam; grades, Improved Large Yorkshire and Berkshire grade dam.

Table II.—Crossbreds, Improved Large Yorkshire sire and Essex dam.

Table III.—Grades, Tamworth sire and Berkshire grade dam.

Table IV.—Crossbreds, Improved Large Yorkshire sire and Berkshire dam.

2. The breeding of the swine which gave the least increase per pound of feed consumed was:—

Table I.—Purebreds, Improved Large Yorkshire.

Table II.—Purebreds, Improved Lorge Yorkshire.

Table III.—Crossbreds, Essex sire and Improved Large Yorkshire dam.

Table IV.—Crossbreds, Berkshire sire and Tamworth dam.

3. There was no constant or appreciable superiority in the breeds and breeding tested in respect to the quantity of feed consumed per pound of increase in live weight.

4. The difference in the thriftiness, or power to increase in live weight per pound of feed consumed, was greater between different animals in the same litter than between breeds or breeding as such in different litters.

5. On the whole, for fattening purposes crossbred swine and grades gave better results than purebreds.

WORK AT OTHER STATIONS.

Some work done along this line at Guelph is well summarized by Prof. G. E. Day, in bulletin 129, from which the following extract is copied:—

'The table given below shows the average amount of meal required for 100 pounds gain, live weight, in the five experiments. In the making up of this table only the meal has been considered. Such foods as dairy by-products and green feed, which were fed sometimes, were the same for all breeds, and have been omitted to simplify the comparison.

'The following shows the average amount of meal consumed for 100 pounds gain, live weight, in five experiments:

'Berkshire..	364·45
Yorkshire..	369·51
Tamworth..	380·47

Duroc Jersey..... 384·23
Chester White..... 387·89
Poland China..... 391·42

Before any conclusions are drawn from the table given above, a second table will be presented for consideration in connection with it.

Table showing the standing of the breeds for each year, each column being ranked in order of economy of gain for each year of the experiment:—

TABLE V.

1896.	1897.	1898.	1899.	1900.
Berkshire	Berkshire	Yorkshire	Berkshire	Berkshire
Tamworth	Tamworth	Berkshire	Tamworth	Yorkshire
Poland China	Poland China	Duroc Jersey	Yorkshire	Duroc Jersey
Duroc Jersey	Chester White	Tamworth	Chester White	Chester White
Chester White	Yorkshire	Chester White	Duroc Jersey	Tamworth
Yorkshire	Duroc Jersey	Poland China	Poland China	Poland China

In considering these tables we must bear in mind that averages are frequently misleading. For example, in a certain experiment one breed may suffer from some unfavourable circumstance which is in no way related to or influenced by the breeding of the animals; yet this circumstance may seriously affect the average standing of the breed in question.

A study of the last table reveals the fact that there is little or no constancy in the standing of any one breed, except the Berkshires, which certainly make a remarkably good showing. It may be possible that the Berkshires were able to digest and assimilate a larger percentage of their food than were the other breeds, but we believe that at least a large share of their success was due to another cause. All the pigs used in these experiments were purchased at ages varying from six to ten weeks, and it was noted that the Berkshires seemed to adapt themselves to the new conditions and change of food more readily than any of the other breeds, and thus scored an advantage at the commencement of the experiment, which they generally held until the close. We are inclined, therefore, to attribute their high standing to their ability to adapt themselves to changed conditions rather than to their power to digest and assimilate a larger percentage of their food.

In 1896, Mr. A. Mackay, at Indian Head, experimenting with different breeds of swine, says:—

To test the difference in growth between large Yorkshires, Tamworths and cross-bred pigs, two animals from each of these breeds were put into one pen on August 4, and fed all they could eat till November 24, or in all, 111 days.

The weight and age of each lot at the commencement and weight at close of the test will be found below, together with the amount of gain, which shows slightly in favour of the Tamworth breed. No Berkshires were available at the time, or they would have been added to the test.

TABLE VI.

Breed.	Age.		Weight at Start of Test.	Weight at Close of Test.	Gain.
	Months.	Days.	Lbs.	Lbs.	Lbs.
Large Yorkshires	4	8	124	404	280
Tamworths	3	27	141	456	315
Cross-breds	2	26	96	400	304

METHODS OF WINTERING.

WINTERING SOWS, OUTSIDE VS. INSIDE.

Where much pasturing of pigs is carried on the wintering of the sows and the fall litters is always a problem of considerable difficulty, since the full utilization of pastures requires pigs ready to turn out at an early date in the spring.

During the winter of 1903-04 a number of the brood sows were housed in the small single board cabins used on the pastures in summer. They did well and were healthy, but cost about twenty-five per cent more to maintain in good condition than did their mates housed in the regular brood sow run or house.

RAISING YOUNG PIGS.

A problem that confronts the farmer who wishes to go heavily into bacon production is the raising of young pigs to the age of three or four months, without the help of skim-milk or whey. This difficulty is more particularly noticed in winter or autumn. To gain some information as to the probably best meal mixtures for the purpose, two experiments were tried in January, February and March, 1904. One was conducted outside with pigs housed in small cabins, as mentioned above, and the other inside the regular piggery.

In determining the value of a meal mixture, the items to be considered are the rate of gain and the cost of 100 pounds increase in weight.

WINTERING YOUNG PIGS, OUTSIDE VS. INSIDE.

A study was also made of the comparative economy of feeding fall pigs outside and inside.

Below is a statement of the results secured. There were two lots inside and two lots outside. The lots were from two different litters, some from each being inside and the rest outside.

TABLE VII.

YOUNG PIGS WINTERED INSIDE vs. OUTSIDE.

—	Lot 1.	Lot 2.	Lot 3.	Lot 4.	Lots 1 & 3.	Lots 2 & 4.
Location	Inside.	Outside.	Inside.	Outside.	Inside.	Outside.
Number of pigs in lot	5		4	7	9	11
Number of days on feed.....Days.	60	60	60	60	60	60
Description of ration fed.... Lbs	Shorts 100 Gluten 100	Shorts 100 Gluten 100	Oil meal 100 Shorts 400	Shorts 400 Oil meal 100	Mixed meals.	Mixed meals as inside.
Pounds of mixture required for 100 lbs. gain	417	552½	280	502	365½	526
Amount fed in period.....Lbs.	993	1,071	400	1,265	1,393	2,336
Value..... $	10·67	11·51	4·00	12·65	14·67	24·16
Gain made by lot.....Lbs.	238	192	143	252	381	444
Average gain per pig..... "	48	48	35¾	36	42½	40½
Average rate of gain per diem. "	·32	·30	·6	·6	·70	·68
Cost of 100 lbs. increase in live weight ..... "	4·48	6·00	2·80	5·02	3·85	5·42
Health and appearance	Good.	Good.	Good.	Good.	Good.	Good.
Weight of lot to start.....Lbs.	496	400	181	331	677	731
Average weight to start .... "	99	100	45¼	47	75	66½
Weight of lot at finish..... "	734	592	324	583	1,058	1,175
Average weight at finish. .. "	147	148	81	83	117½	107

INSIDE FEEDING.

When similar feeds were fed inside much better results were noted, both the rate of gain per day being slightly increased and the cost of production lowered. The mixture of shorts 4 parts and oil 1 part coming to the fore, as gains were made at a cost of $2.80 per 100 lbs. gain, and at the rate of 6-10ths pound per pig per day.

TABLE VIII.

RATIONS FOR YOUNG PIGS INSIDE.

—		Lot 1.	Lot 2.	Lot 3.	Lot 4.	Lot 5.
Number of pigs in lots		5	4	5	4	5
Location		Inside.	Inside.	Inside.	Inside.	Inside.
Number of days on feed		40	40	60	60	60
Description of ration fed		Oil meal 200 Shorts 200 Gluten 200 Oats 200 Skim-milk 4½ lbs. a day	Shorts. Skim-milk.	Shorts 100 Gluten 100	Shorts 400 Oil meal 100	Oats 100 Oil meal 100
Pounds of mixture required for 100 pounds gain	Lbs.	190 meal, 564 skim-milk.	152 meal, 564 skim-meal.	417	280	322
Amount fed in period	"	252 meal, 750 milk.	204 meal, 756 milk.	993	400	699
Value	$	3·94	2·96	10·67	4·00	8·04
Gain made by lot	Lbs.	133	134	238	143	217
Average gain per pig	"	26½	33½	48	35¾	44¼
Average rate of gain per day	"	·66	·84	·82	·6	·74
Cost of 100 lbs. increase in live weight	$	2·94	2·21	4·48	2·80	3·70
Health and appearance		Very good.	Excellent.	Good.	Good.	Good.
Weight of lot to start	Lbs.	183	122	496	181	379
Average weight to start	"	36½	30½	99	45¼	76
Weight of lot at finish	"	316	256	734	324	595
Average weight at finish	"	63	64	147	81	119

OUTSIDE FEEDING.

An examination of the reports of the experiments carried on outside, submitted below, shows that a mixture of shorts 4 parts and oil meal 1 part produced pork for $5.02 per 100 pounds at the rate of 6-10ths of a pound per day. Shorts and gluten meal, equal parts, produced pork at a more rapid rate, viz., 8-10ths pounds per day, but at a slightly higher cost, viz., $6 per 100 pounds. The difference may have been due to the difference in the age of the pigs. A mixture of shorts and oil meal, equal parts, gave very poor results, since it cost $7.93 to produce 100 pounds, live weight, at the rate of 47-100th pounds per pig per day.

TABLE IX.

RATIONS FOR YOUNG PIGS OUTSIDE.

—	Lot 3.	Lot 4.	Lot 6.	Lot 7.	Lot 8.	Lot 9.
Number of pigs in lot	4	4	6	7	4	4
Location	Outside.	Outside.	Outside.	Outside.	Outside.	Outside.
No. of days on feed	60	60	60	60	60	60
Description of ration fed	Shorts 100 Gluten 100	Shorts 100 Oil meal 100	Oats 200 Shorts 100	Shorts 400 Oil meal 100	Oats 100 Shorts 200	Shorts 400 Oil meal 100 Gluten 100 Skim-milk. 4½ lbs. per d
Pounds of meal mixture required for 100 lbs. gain	552½	721	600	502	600	Meal 281½ Milk 766
Amount fed in period ... Lbs.	1,071	808	1,080	1,265	1,176	Milk 1,134 Meal 417
Value ... $	11·51	8·88	10·80	12·65	11·76	5·49
Gain made by lot ... Lbs.	192	112	180	252	196	148
Average gain per pig ... "	48	28	30	36	28	27
Daily rate of gain ... "	·8	·47	·5	·6	·47	·62
Cost of 100 lbs. increase in live weight ... $	6·00	7·93	6·00	5·02	5·70	3·82
Health and appearance	Good.	Good.	Good.	Good.	Fair.	Excellent.
Weight of lot to start ... Lbs.	400	155	384	281	556	256
Average weight to start ... "	100	38.7	64	47	81	64
Weight of lot at finish ... "	592	267	564	582	762	403
Average weight at finish ... "	148	66.7	94	83	109	101

FEEDING IN PASTURE AS COMPARED WITH FEEDING IN PENS.

Mr. R. Robertson, at Nappan, experimenting with pigs, writes:—

An experiment carried on in the summer of 1902-03 was repeated this year with pigs of one month old, in two lots of ten each, of various breeds and crosses, each lot consisting of an equal number from each litter and termed lot I. and lot II.—lot I. in pasture and lot II. in pens.

Lot I. were fed an average daily ration of 2 pounds meal, largely shorts, and 5 pounds skim-milk, from July 1 to November 1, and pasture which consisted of clover, rape, hairy or sand vetch, and spring vetch and peas mixed sown on different parts of a field of one acre in extent.

Lot II. were fed the same daily ration in pens.

A portable house was used for shelter. On November 1 the pigs were taken into pens, and fed a ration of 3 pounds meal until December 1.

The results are as follows:—

TABLE X.

Lot I. fed on pasture, July 1 to November 1; fed in pens, November 1 to December 1.

Period.	Weight at Start.	Weight at Finish.	Gain.
	Lbs.	Lbs.	Lbs.
July 1 to November 1	170	1,129	959
November 1 to December 1	1,129	1,609	480
Total gain, 10 pigs, 153 days	.....	.....	1,439

	Lbs.
Average daily gain on pasture, July 1 to November 1	·78
Cost per pound gain, entire period ... cts.	3 55
Average daily gain in pens, November 1 to December 1	1·60

TABLE XI.

Lot II. fed in pens, July 1 to December 1, 1904.

Period.	Weight at Start.	Weight at Finish.	Gain.
	Lbs.	Lbs.	Lbs.
July 1 to March 1	185	1,169	984
November 1 to December 1	1,169	1,472	303
Total gain, 10 pigs, 153 days	.....	.....	1,287

	Lbs.
Average daily gain in pens, July 1 to November 1	·80
Average daily gain in pens, November 1 to December 1	1·01
Cost per pound gain, entire period ..... cts.	3·94

FEEDING PIGS ON PEASE IN THE FIELD.

In 1904 Mr. S. A. Bedford, at Brandon, writes as follows:—

Field pease give large returns in this province, but the one great obstacle to their general cultivation is the difficulty in harvesting and threshing the crop. With the object of overcoming this difficulty a trial was made of turning a number of pigs into one acre of nearly ripe pease and allowing them to do the harvesting and threshing.

Ten pigs were used for this test. They were all of mixed breeding, and cost on September 3, $4.75 per hundred pounds. It was found necessary to ring them, otherwise they covered many of the pease in rooting up the soil.

The variety of pea used was Canadian Beauty, sown on one acre of summer-fallow land on May 7. Pigs were turned into the field on September 3, and by October 20 they had all the grain eaten clean.

SUMMARY.

Group of Ten Pigs.

Weight when bought ..... lbs.	1,393
Value when bought	$66 16
Weight when sold ..... lbs.	1,670
Value when sold	$83 50
Profit on one acre peas fed to pigs	$17 34

EXPERIMENTS IN FEEDING SKIM-MILK.

The value of skim-milk as a feed for pork production has always been well known, and the following experiments were devised for the purpose of giving some exact data which might be used as a guide to the feeder rather than for the purpose of settling some disputed question of establishing some doubtful feed on better grounds. Some of the experiments summarized in the following table were conducted with the sole purpose of determining the value of this by-product, while others have been introduced as illustrating to a greater or less extent the value of this feed. The very great value of this substance must not be measured by its chemical composition solely; but its peculiar, apparently stimulating action upon the growth of animals must be considered. The following data are accordingly submitted:—

TABLE XII.

Experiment.	Feed.	How Prepared.	No. of Swine.	Average weight at start.	Average weight at finish.	Average net gain.	Number of days fed.	Average daily gain.	Average amount feed eaten.	Average amount feed for 1 lb. gain.
				Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.
1	Meal	Soaked 30 hours	3	117	230	113	112	1·00	483	4·27
2	Meal (half quantity fed in experiment 1).	Soaked 30 hours	4	103	246	143	112	1·27	181	1·26
	Skim-milk								3,631	25·39
3	Wheat shorts	Soaked 30 hours	5	179	261	82	56	1·46	509	3·80
	Skim milk								536	4·10
4	Meal: pease, wheat and rye.	Ground and soaked 18 hrs.	2	123	196	73	56	1·30	250	3·43
5	Meal, as in 4 (but only ¾ amount).	Soaked 18 hours	2	120	206	86	56	1·54	188	2·17
	Skim milk								960	11·10
6	Meal, as in 4 (but only ½ amount).	Soaked 18 hours	2	116	202	86	56	1·54	125	1·45
	Skim milk								1,332	15·49
7	Corn	Ground and soaked 30 hrs.	4	74	172	98	112	·87	408	4·16
8	Corn	Whole, soaked 54 hours	3	72	190	118	91	1·30	343	2·90
	Skim milk								273	2·31
9	Pease	Whole. soaked 54 hours	4	100	207	107	84	1·27	356	3·33
	Skim milk								252	2·35
10	Barley	Ground, soaked 54 hours	4	73	184	111	112	1·00	483	4·35
11	Barley	Whole, soaked 54 hours	4	99	199	100	84	1·19	364	3·64
	Skim milk								252	2·52
12	Pease, barley and rye	Whole, soaked 48 hours	5	69	156	87	119	·73	386	4·45
13	Pease, barley and rye	Whole, soaked 48 hours	5	69	204	135	119	1·13	330	2·46
	Skim milk								1,869	13·92
14	Pease, barley and rye	Ground and soaked 12 hrs.	5	69	173	104	119	·87	455	4·36
15	Pease, barley and rye	Ground and soaked	4	76	210	134	119	1·12	464	3·46
	Skim milk								645	4·81

CONCLUSIONS

From these tests to gain information as to the feeding value of skim milk, it appears that:—

1. When swine were fed with meal, barley, rye and wheat alone 4·27 pounds were required to give one-pound gain, but when swine were fed upon similar meal, half the quantity being given, and all the milk they could consume, only 1·26 pounds of meal were required for one-pound gain, and 25·39 pounds skim-milk. One pound of meal would thus be worth 8·43 pounds milk.

2. A mixture of pease, wheat and rye gave one pound pork for each 3·43 pounds fed. (Exp. 4.) For comparison, a similar number of swine (Exp. 5) were given three-quarters the quantity of the same meal and all the skim-milk they would drink. It was then found that 2·17 pounds meal and 11·10 pounds skim milk gave one pound increase in weight. According to these data skim-milk may be said to bear the relation of 8·82 pounds to one of meal.

3. In Exps. 7 and 8 the use of skim-milk with corn is exemplified. It will be observed that in the one case the corn was whole, while it was ground in the other. The longer period for which the whole corn was soaked in the one case may be expected, however, to exert as great an influence as the grinding in the other upon the portion of nutrients available. The data obtained from these experiments would indicate that 1·83 pounds skim-milk were equivalent to one-pound of corn. While this is not exactly in accordance with the results of other experiments here it serves to emphasize the great value of skim-milk as a supplementary food, and as a supplement to no other grain does its effect seem so marked as when used with corn.

4. In Experiments 10 and 11, with barley and milk, the same conditions obtain as are discussed in the preceding paragraph. It will be observed that while of barley fed alone 4·35 pounds were required to produce one pound of pork, only 3·64 pounds were required for the same effect when fed with 2·52 pounds of milk. Here also the feeding value of skim-milk seems very much greater than most work along this line would indicate.

5. In Experiments 12 and 13 the use of milk with a mixture of pease, barley and rye fed whole, as compared with the same mixture fed alone, is illustrated. The mixture seems to bear the relation of 1 to 6·99 pounds of milk.

6. In Experiments 14 and 15 a meal composed of equal parts of ground pease, barley and rye was fed in the one case without milk when 4·36 pounds were required to produce one pound of pork, and in the other case with all the skim-milk the pigs would consume in addition to the grain ration when 3·46 pounds meal and 4·81 pounds skim-milk produced one pound pork. Skim-milk, according to this experiment, would be worth about one-fifth (100-534) as much as an equal weight of the meal.

7. In addition to the above work, a summary of some other work is submitted below.

From tests made in 1892, 1893 and 1894 with 48 swine, it appears that when a small quantity (about three pounds per head per day) of skim-milk was fed, a less quantity of it was equal to one pound of the grain in the feed consumed per pound of increase in live weight, than when a large quantity (about 15 pounds per head per day) was fed.

The results are shown in the following table:—

TABLE XIII.

Number of Swine in Test.	Skim-milk consumed per head per day.	—
	lbs.	
4	2	1 pound corn equal to 1·83 pounds skim-milk.
31	3	1 pound mixed grain equa to 3·23 pounds skim-milk.
4	5·4	1 " " " 5·38 " "
4	13·6	1 " frosted wheat " 7·91 " "
5	15·7	1 " mixed grain " 7·34 " "
2	17·1	1 " " " 8·82 " "
2	23·7	1 " " " 7·76 " "

General Conclusions.—From these tests and from our experience in feeding young pigs, it appears that:—

(1.) For the fattening of swine weighing on the average over 100 pounds each, live weight, it is economical to give an allowance of skim-milk not exceeding five pounrs per head per day.

(2.) Skim-milk gives the best returns for the amount fed when it constitutes a comparatively small part of the total food fed.

(3.) Skim-milk may, generally speaking, be considered to be worth from one-sixth to one-fifth as much as mixed grain.

FEEDING SKIM-MILK AT NAPPAN.

With a view to determine the value obtainable for skim-milk when fed to pigs under existing markets for feed and products, three lots of pigs were fed during the year 1902.

Lot 1 were fed an average of 20 pounds skim-milk per pig per day, and lots 2 and 3 an average of 25 pounds skim-milk per pig per day. A daily average of two pounds wheat shorts were also fed to each pig. Lots 1 and 3 were valued at $2 each pig, and lot 2 at $3 each at the beginning of the test. The results were as follows:—

TABLE XIV.

SKIM-MILK TEST.

Lots.	Breeding.	No. Swine	Age.	Weight at Start.	No. of Days Fed.	Weight at Finish.	Dressed Weight.	Value.	First Cost.	Cost Meal Feed	Value per 100 lbs. Milk.
			months	Lbs.		Lbs.	Lbs.	$ cts.	$ cts.	$ cts.	Cts.
1	Berkshire.	3	1	77	110	435	369	22 14	6 00	6 60	14·45
2	"	3	2	216	125	369	558	30 69	9 00	7 50	15·13
3	Yorkshire	3	1	132	165	900	720	43 20	8 00	13 20	17·77

WHOLE *VS.* GROUND GRAIN.

EXPERIMENTS CONTRASTING THE VALUE OF WHOLE GRAIN WITH SIMILAR GRAIN WHEN GROUND, AS A PORK PRODUCER.

It is generally conceded that there is more or less waste when grain is fed whole to swine. Many feeders maintain, however, that the gains are practically the same from equal weights of grain whether fed whole or ground. To get some data on this point, a number of experiments have been carried on here.

The following gives a summary of the results with ten groups of pigs fed at different times and with different feeds:—

TABLE XV.

Experiment.	Feed.	How Prepared.	No. of Swine.	Average weight to start.	Average weight at finish.	Average net gain.	No. of days fed.	Average daily gain.	Average amount feed eaten.	Average amount feed for 1 lb. gain.
				lbs.	lbs.	lbs.		lbs.	lbs.	lbs.
1	Pease, barley and rye	Whole, soaked 48 hours.	5	69	156	87	119	·73	386	4·45
2	" " "	Ground, soaked 12 hours	5	69	173	104	119	·87	455	4·36
3	" " "	Whole, soaked 48 hours.	5	69	204	135	119	1·13	330	2·46
	Skim-milk								1869	13·92
4	Pease, barley and rye.	Ground, soaked 12 hours	4	76	210	134	119	1·12	464	3·46
	Skim-milk								645	4·81
5	Oats, barley, pease and ½ part bran	Whole, dry	4	67	175	108	119	·90	441	4 08
6	" " "	Ground, dry	4	69	195	126	119	1·06	450	3·56
7	" " "	Whole, soaked 30 hours	4	66	171	105	119	·88	409	3·88
8	" " "	Ground, soaked 30 hours	4	66	190	124	119	1·04	467	3·76
9	Oats, pease and barley	Whole, dry	4	103	185	82	76	1·08	307	3·60
10	" "	Ground, dry	4	101	190	89	76	1·17	307	3·43

A study of the above table would seem to show that:—

1. When, pease, barley and rye were fed whole, ·09 pounds more of the mixture was required to produce a pound of pork than when fed ground. This is a gain of two per cent.

2. Lots 3 and 4 were given in each case all the skim-milk they would drink. While no exact feeding value can be attached to the skim-milk, yet a considerably greater gain is indicated from grinding the feed than in lots 1 and 2.

3. In lots 5 and 6, where a ration of oats, barley and straw was fed, first with the grain part unground and second with the grain part ground, a large gain is indicated, viz., 20 per cent.

4. In lots 7 and 8, where a similar ration to that in lots 5 and 6 was fed with the difference that in lots 5 and 6 it was fed dry, and in lots 7 and 8 it was fed soaked, a smaller gain of about 3 per cent is shown in favour of the ground feed.

5. In lots 9 and 10 a mixture of oats, pease and barley is fed whole, and contrasted with a similar mixture when fed ground. A gain of almost 4 per cent is shown in favour of the ground feed.

6. While the results vary considerably, it will be observed that in every case a gain is noticeable where ground feed is used rather than whole feed. It is quite safe to say that a gain of from 5 to 10 per cent may be looked for when ground grain rather than unground is fed.

In some experiments conducted here with whole grain an effort was made to ascertain the per cent of grain that escaped digestion when it was fed whole. The excrement was collected for 24 hours after the animals had been on a fixed ration of one variety of grain for some weeks, and the following results obtained:

(*a*) In case of whole oats where 14 pounds feed was fed, 2 lbs. 6 oz. of undigested grain, or 21·6 per cent of the whole amount, was found in the excrement. One-tenth of this germinated.

(*b*) In the case of whole barley, where 17 pounds was fed, 21 lbs. 2 oz. or 12½ per cent of the whole amount was found in the excrement. None of this would germinate.

(*c*) In the case of whole pease, where 17 pounds was fed, 2 oz. only, or about ¾ of 1 per cent of the whole amount was found in the excrement. None of this would germinate.

(*d*) In the case of whole corn, where 11 pounds was fed, 8 oz., or nearly 5 per cent of the whole amount, was found in the excrement. About one twelfth of this germinated.

(*e*) In the case of unground mixed grain (oats, pease and barley), where 11 pounds of grain was fed 10 oz., or 5·7 per cent of the whole amount, was found in the excrement. About one-fiftieth (oats) of this germinated.

COOKED *vs.* RAW.

EXPERIMENTS TO DETERMINE THE VALUE OF STEAMED OR COOKED FEED, FED WARM, AS CONTRASTED WITH RAW FEED, FED COLD, INCLUDING AN EXPERIMENT WITH PEA ENSILAGE.

The following report is taken with slight changes from the report for 1891:—

The object of this experiment was twofold: (1) to discover the difference, if any, in the quantity of grain required to produce every pound of increase of the live weight of the swine, when fed, steamed and warmed in the one case, and when fed raw and cold in the other case; (2) to obtain a record of the comparative quantities of grain required to produce every pound of increase in the live weight of the swine during the different stages of the feeding period. The grains fed were ground peas, barley and rye, equal parts.

The mixture of grain was fed wet in both cases. Cold water was given to drink. A mixture of salt and wood ashes was kept in a box on the floor of each pen, where the pigs had access to it at will. In the following table the feeding period has been

arranged into five periods of four weeks each and one period of three weeks. It shows the gain in weight and the quantities of grain consumed.

TABLE XVI.

—	9th December.	5th January.	2nd February.	2nd March.	30th March.	27th April.	18th May.	Totals.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Pen 1—Four Swine.								
Fed on a mixture of ground pease, barley and rye, *fed steamed and warmed* :								
Live weight	302	407	614	808	917	974½	745*	....*Three swine only.
Gain in weight	.....	105	207	194	109	57½	30	702½, gain in weight.
Feed consumed	.....	348	639	736	545	406	256	2,928, grain consumed.
Feed consumed per lb. of gain in live weight	.....	.....	.....	.....	.....	.....	.....	4·16 lbs. grain.
Pen 2—Four Swine.								
Fed on a mixture of ground pease, barley and rye, *fed raw and cold* :								
Live weight	308	413½	597	723	781½	830½	872	
Gain in weight	.....	105½	183½	126	58½	49	41½	564, gain in weight.
Feed consumed	.....	348	563	558	413½	278½	237	2,398, grain consumed.
Feed consumed per lb. of gain in live weight	.....	.....	.....	.....	.....	.....	.....	4·25 lbs. grain.
Pens 1 and 2.								
Average weight of pigs	76	102½	151	191	212	225½	231	
Average feed consumed per lb. of gain in live weight	.....	3·31	3·07	4·04	5·73	6·45	6·93	
Percentage of increase in feed consumed per lb. of gain in live weight	.....	.....	.....	31%	86%	110%	125%	

In this experiment the object was to discover the value, if any, of pea ensilage for the feeding and fattening of swine.

Records were also kept to ascertain the comparative quantities of feed required to produce every pound of increase in the live weight of the swine during the different stages of the feeding period.

The pea ensilage was prepared by harvesting the crop when the earliest pods were filled and before the peas became hard. The vines were green and succulent. The ensilage was well preserved. The pigs in lot 3 were fed an allowance of grain, a mixture of equal parts of ground peas, barley and rye, but not as much as they would have eaten readily. They were fed also a quantity of pea ensilage. The pigs in lot 4 were fed upon pea ensilage only. In both cases the pigs refused to eat more than a small portion of whatever quantity of pea ensilage was offered to them. The remainder was nosed over, pushed about and tramped on. When what was left uneaten was weighed out of the pens, it was very wet.

Both lots of pigs were allowed cold water to drink, and a mixture of salt and ashes was accessible to the pigs in both cases. The pea ensilage did not seem to have any feeding value to the pigs which received an allowance of grain; and the pigs in lot 4 steadily decreased in weight for nine weeks when the feeding of ensilage was ended.

The following table contains the details of the weights of pigs, feed consumed, and rate of gain in live weight:—

TABLE XVII.

—	29th December.	5th January.	2nd February.	2nd March.	30th March.	27th April.	18th May.	Totals.
Lot 3—Four swine.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Fed on a mixture of ground pease, barley and rye, *fed, steamed and warmed*, and pea ensilage—								
Live weight	254	267	414	*379	442	494	548	*Three swine only.
Gain in weight	...	13	147	74	63	52	54	403, gain in weight.
Feed consumed. Grain	...	63	474	335	287	260	243	1,662. grain consumed.
Feed consumed. Pea ensilage	...	112½	682	345				
Pea ensilage left uneaten (wet)	...	100	625	319				
Grain consumed per lb. of gain in live weight	...	...	...	...	...	...	...	4·12. grain.
Lot 4—Four swine.								
Fed on pea ensilage only until 2nd March—								
Live weight	256	237	223	205				
Loss in weight	...	19	14	18	...	...	...	51, loss in weight.
Pea ensilage fed	...	235	1401	2127	...			
Pea ensilage left uneaten (wet)	...	150	938	1409	..			
After 2nd March, fed on a mixture of ground pease, barley and rye, *fed raw and cold*—								
Live weight	...	...	...	205	395½	512½	571	
Gain in weight	...	...	...	...	190½	117	58½	366, gain in weight.
Feed consumed	...	...	...	...	443	383	327	1,158, grain consumed.
Feed consumed per lb. of gain in live weight	...	...	...	...	2·32	3·31	5·59	3·16, grain.
Lots 3 and 4.								
Average feed consumed per lb. of gain in live weight	..	4·84	3·22	4·52	2·88	3·83	5·06	

Lots 5 and 6 were fed similarly to lots 3 and 4, save that sugar beets were substituted for pea ensilage.

Table XVIII.

Shows the weights of the swine, the gains in weight, and the quantities of feed consumed.

—	9th December.	5th January.	2nd February.	2nd March.	30th March.	27th April.	18th May.	Totals.
Lot 5—Four Swine.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Fed on a mixture of ground pease, barley and rye, *fed steamed and warmed*, and sugar beets—								
Live weight	187	258	425	581	669	744½	812	
Gain in weight	....	71	167	156	88	75½	67½	625, gain in weight.
Feed consumed.. Grain	....	333	412	540	475	369	282	2,411, grain consumed.
Feed consumed.. Sugar beets	....	44½	330	313	320	308	224	1,538, sugar beets consumed.
Feed consumed per lb. of gain in weight..	...	....	...	...	....	....	....	3·86, grain. 2·46, sugar beets.
Lot 6—Four Swine.								
Fed on a mixture of ground pease, barley and rye, *fed raw and cold*, and sugar beets—								
Live weight	201	272	415	547	692	731	772	
Gain in weight	....	71	143	132	145	39	41	571, gain in weight.
Feed consumed.. Grain	....	225	396	503	458	371	270	2,223, grain consumed.
Feed consumed.. Sugar beets	....	60	320	307	310	322	244	1,503, sugar beets consumed.
Feed consumed per lb. of gain in live weight	..	....	....	...	....	....	....	3·89, grain. 2·73, sugar beets.
Lots 5 and 6.								
Average feed consumed per lb. of gain in live weight. Grain	....	3·93	2·61	3·62	4·00	6·50	4·33	
Average feed consumed per lb. of gain in live weight. Sugar beets	....	0·72	2·10	2·15	2·73	5·52	5·11	
Percentage of increase in feed consumed per lb. of gain in live weight	...	....	....	21 per ct.		90 per ct.		
1 lb. grain equal to 5 lbs. sugar beets	...	....	....	..	....	....	....	

The following table shows the quantities of feed consumed per pound of gain, live weight, during each of the six feeding periods. The duration of each period was four weeks, with the exception of the first period, for pens 4 and 5, and the last period for all the pens, which was three weeks. The grain fed in each case was a mixture of equal parts of ground pease, barley and rye. No notice is taken in this table of the pea ensilage fed to lots 4 and 5, as it did not appear to have any appreciable feeding value in these cases:—

TABLE XIX.

Pounds of feed consumed per pound of gain in the live weight of swine.

Feeding Periods.	Lot 1, four swine; grain, fed steamed and warm.	Lot 2, four swine; grain, fed raw and cold.	Lot 3, four swine; grain, fed steamed and warm.	Lot 4, our swine; grain, fed raw and cold.	Lot 5, four swine; grain, fed steamed and warm, and sugar beets.		Lot 6, four swine; grain, fed raw and cold and sugar beets.	
					Grain.	Sugar Beets.	Grain.	Sugar Beets.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
First	3·31	3·30	4·84	.....	4·69	0·61	3·17	0·84
Second	3·07	3·07	3·22	.....	2·46	2·00	2·76	2·23
Third	3·79	4·43	4·52	.....	3·46	2·00	3·81	2·32
Fourth	5·00	7·07	4 55	2 32	5·40	3·63	3·15	2·13
Fifth	7 06	5·68	5·00	3·31	4·88	4·08	9·51	8·25
Sixth	8·53	5·71	4·50	5·59	4·17	3·31	6·58	6·00
Average	4·16	4·25	4·12	3·16	3·86	2·46	3·89	2·73

Conclusions.—The teaching of these sets of experiments is to the effect that:—

(1.) There is no appreciable difference in the number of pounds of grain required to produce every pound of increase in the live weight of swine, when fed steamed and warm, as against raw and cold.

(2.) On the average there is a gradual increase in the quantity of feed consumed, for every pound of gain in live weight of swine, after the second month of their feeding period and after the average live weight exceeds 100 pounds.

(3.) It is most economical to market swine for slaughtering when they weigh from 180 to 200 pounds alive.

(4.) The largest consumption of feed per day by swine is at or near the period of their feeding when the number of pounds of feed consumed, per pound of increase in weight, is lowest:—

(5.) For the increase of weight by 3,231½ pounds in 24 swine, 4:14 pounds of a mixture of ground pease, barley and rye were required for every pound of increase in live weight.

SOAKED *VS.* DRY.

EXPERIMENTS TO DETERMINE THE VALUE OF SOAKED FEED AS CONTRASTED WITH SIMILAR FEEDS FED DRY.

It will be seen by referring to page 26 that experiments with cooked feed (grains) would indicate that the increased returns from cooked feed were not sufficient to pay for the extra work and expenditure. The nearest approach to cooking at practically no expense is soaking the food, and the following experiments were carried on along this line. A number of other experiments include some data on this point, but they are so complex as to render their consideration under this head inadvisable.

TABLE XX.

Experiment.	Feed.	How Prepared.	No. of Swine.	Average weight to start.	Average weight to end.	Average net gain.	No. of days fed.	Average daily gain.	Average amount feed eaten.	Average amount feed for 1 lb. gain.
				lbs.	lbs.	lbs.		lbs.	lbs.	lbs.
1	Peas, barley and rye.	Whole and soaked 30 hours.	4	66	171	105	119	·88	409	3·88
2	" ..	Whole, dry.....	4	67	175	108	119	·90	441	4·08
3	" ..	Grou. d, soaked 30 hours.	4	66	190	124	119	1·04	467	3·76
4	" ..	Ground, dry.....	4	69	195	126	119	1·06	450	3·56

It will be observed that in lots 1 and 2 where whole grain was fed, that a considerable saving was apparently wrought in feed by soaking the grain. This amounted to about 6 per cent of the food fed lot 2. In lots 3 and 4 it will be observed that ground grain was fed dry and compared with ground grain soaked. The data here would seem to point to a loss from soaking meal. While this may not be the actual case, yet it is probable that the result from soaking meal may not be so marked as from soaking whole grain. A study of some other experimental work not submitted under this head would also indicate this.

BOILED WHEAT *vs.* SOAKED WHEAT.

In 1894 Mr. A. Mackay, at Indian Head, says:—

During last winter a test was made between feeding pigs on soaked wheat and on boiled wheat, resulting in favour of soaked wheat.

Two pens of four pigs each (a mixed lot) were put up on December 6, and fed until April 6. One pen was fed on wheat soaked for 24 hours and the other on boiled wheat.

Following is the result in detail:

Pen No. 1—Soaked.—Weight: Dec., 317 lbs.; Jan., 443 lbs.; Feb., 536 lbs.; Mar., 664 lbs.; April, 784 lbs. Gain, 467 lbs.

Pen No. 2—Boiled.—Weight: Dec., 275½ lbs.; Jan., 374 lbs.; Feb., 447 lbs., Mar., 517 lbs.; April 627 lbs. Gain, 351½ lbs.

The pigs in pen No. 1 consumed 2,160 pounds wheat; the pigs in pen No. 2 consumed 2,100 pounds wheat.

Therefore, in this experiment it took 4½ pounds soaked wheat to make one pound of pork, and 6 pounds of boiled wheat to make the same quantity.

Pork at 6 cents per pound would make the wheat consumed in pen No. 1 worth 74 cents, and in pen No. 2 worth 60 cents per bushel.

FROZEN WHEAT EXPERIMENTS.

The unsaleable character of some of the wheat which has been occasionally more or less affected by frost in some parts of Manitoba and the Territories led to some experiments being carried on to ascertain the approximate value of this injured grain as a feed for swine. It was fed alone, ground and unground, soaked in either case. It was also fed in conjunction with other cereals and along with skim milk.

The following table gives in condensed form a summary of this series of experiments:—

TABLE XXI.

Experiment.	Feed.	How prepared.	No. of Swine.	Average weight at start.	Average weight at finish.	Average net gain.	Number of days fed.	Average daily gain.	Average amount of feed eaten.	Average amount feed for 1 lb gain.
				lbs.	lbs.	lbs.		lbs.	lbs.	lbs.
1	Wheat	Ground and soaked 12 hrs.	4	185	275	90	77	1·17	479	5·30
2	Wheat	Whole soaked 42 hrs.	4	186	273	86	77	1·11	570	6·59
3	Wheat, barley and pease.	Whole, soaked 42 hrs.	4	187	278	92	77	1·19	557	6·07
4	Wheat	Ground and soaked 12 hrs.	5	61	165	104	120	0·87	441	4·23
5	Wheat Skim-milk	Ground and soaked 12 hrs.	4	104	192	88	56	1·57	233 1011	2·65 12·51
6	Wheat	Ground and soaked 18 hrs.	12	103	187	84	84	1·00	442	5·26
7	Wheat and barley Carrots	Ground and soaked 30 hrs.	21	117	179	62 ...	84	0·73	326 53	4·45 0·85
8	Barley, rye, wheat and bran	Ground and soaked 12 hrs.	36	54	108	54	105	0·51	207	3·85
9	Barley, rye, wheat and bran Skim-milk	Ground and soaked 12 hrs.	31	108 ..	191 ...	83 ...	83 ...	1·00	268 250	3·23 3·00

In 1892, Mr. A. Mackay, at Indian Head, experimenting with frozen wheat as a feed for pigs, says:—

Two large sows, the only pigs available, were shut up on August 22, in an open pen, after being weighed, and fed for two months on frozen wheat soaked in water for twenty-four hours before being fed. The wheat was fed whole.

The pigs were weighed on October 22, and found to have gained 172 pounds; the weights being on August 22, 900 pounds, and October 22, 1,072 pounds.

The price of pork at Indian Head on October 22 was 7 cents per pound. The value of gain in weight would therefore be $12.04.

Nine hundred and sixty pounds, or 16 bushels of wheat were fed in the two months; therefore the value of frozen wheat in pork would in this western country, on the basis of this experiment, be about 75 cents per bushel.

On October 22 the feed was changed, and ground instead of whole wheat was fed, the wheat being wet at times of feeding. On December 2 the pigs were weighed, and found to have gained 50 pounds, having eaten 510 pounds of ground wheat; making price of pork $3.50 and value of grain 41½ cents per bushel.

The difference in gain of pork for amount of wheat eaten may be accounted for partly by the cold weather and partly by the weight and age of the animals.

In above experiments the animals were not in a comfortable house, but exposed to the weather, as the majority of North-west pigs are when fattening, and the experiment may show farmers what may be gained by feeding frozen wheat instead of selling it.

Summary.—It took on an average 6 pounds 1 ounce of wheat during the four months to make 1 pound of pork. Average return per bushel of wheat consumed, 49 cents.

In 1893, Mr. S. A. Bedford, at Brandon, experimenting with frozen wheat as a feed for pigs, says:—

The Berkshire grade pigs were selected for this experiment. They were purchased at five cents per pound, live weight, and sold at the same rate; their combined live weight when the test began, December 7, was 180 pounds. They were fed three times a day all the chopped No. 3 or badly frozen wheat they would eat, clean, mixed with cold water at the time of feeding, the building being too cold to admit of soaking the food for any length of time before using.

The accompanying table will show that this wheat, although badly injured, and fed under unfavourable conditions, realized in its value in pork 49 cents per bushel. The market value of such wheat during the winter of 1891-92 was about 30 cents per bushel, and it would not realize 20 cents this winter.

TABLE XXII.

—	Amount of wheat consumed each month by the two swine.	Gain in pounds of pork each month.	Return per bushel of wheat fed.	Pounds of wheat consumed for one pound of pork.		Weight of the swine at end of month.
	Lbs.	Lbs.	Cts.	Lbs.	oz.	Lbs.
First month	330	67	60	4	14	247
Second "	319	45	42	7	1	292
Third "	294	55	56	5	5	347
Fourth "	313	39	37	8	0	386

VALUES OF GRAINS.

WHEAT ALONE AS COMPARED WITH MIXED GRAIN FOR FATTENING SWINE.

In 1896, Mr. S. A. Bedford, at Brandon, says:—

Many farmers think that wheat alone is neither a safe nor economical feed for swine; to gain information on this point, six cross-bred pigs about three months old and all of one litter were divided into two groups as nearly equal as possible.

In No. 1 pen the pigs were fed on ground wheat alone, soaked; the feed of those in pen No. 2 was a mixture of one-half wheat (by weight), one-quarter barley, and one-quarter oats, all ground and soaked.

Weights.

The three pigs in pen No. 1 consumed 1,606 pounds wheat or 4½ pounds of wheat to produce one pound (live weight) of pork.

Those in pen No. 2 consumed 1,722 pounds mixed grain or 5½ pounds of grain to produce one pound of pork.

If the value of the manure be considered as an equivalent for the labour and attendance, pork at 4c. per pound live weight would make the wheat consumed in pen No. 1 worth 88 cents per hundred pounds, and in pen No. 2 the mixed grain would be worth 72 cents per hundred pounds.

TEST OF WHEAT *vs.* BARLEY AND WHEAT.

In 1894, Mr. A. Mackay, at Indian Head, says:—

In this test 10 improved large Yorkshires were divided into two pens of five pigs each, as nearly equal in weight as it was possible to get them, there being only five pounds difference between the two lots.

One pen was fed on soaked wheat and the other on soaked wheat and barley mixed. The test commenced on September 1, and on November 1 the pigs in pen No. 1, fed on wheat alone, had made one pound of pork for every 8½ pounds wheat used; while pen No. 2, fed on wheat and barley, made one pound of pork for each six pounds grain eaten.

The ten pigs used were born on December 28, 1893, and January 3, 1894, and on account, no doubt, of the extreme cold experienced early in their existence, were small for their age when the test commenced. This may account for the large quantity of grain consumed in comparison with amount of pork made.

Following is test in detail:—

Pen No. 1—Fed on Soaked Wheat.—Weight : Sept. 1, 618 lbs.; Oct. 1, 751 lbs.; Nov. 1, 820 lbs. Gain, 202 lbs.

Pen No. 2—Fed on Soaked Wheat and Barley—Weight : Sept. 1, 623 lbs.; Oct. 1, 778 lbs.; Nov. 1, 898 lbs. Gain, 275 lbs.

Pen No. 1 consumed 1,757 pounds wheat; made 202 pounds pork, or 8½ pounds feed to one pound of pork.

Pen No. 2 consumed 1,668 pounds wheat and barley; made 275 pounds of pork, or six pounds feed to one pound of pork

FEEDING BARLEY TO SWINE.

In 1893, Mr. S. A. Bedford, at Brandon, says:—

The two pigs selected for this test were grade Berkshires, their combined weight at the commencement of the test, December 28, was 117 pounds. These were also purchased at 5c. per pound live weight, and sold at the same rate.

The barley was fed three times a day, chopped and mixed with water at the time of feeding. No more was fed than would be eaten up clean at each meal.

The following results show that the barley fed in this experiment realized in pork 50 cents per bushel; farmers at that time were selling same grade of barley on the market at an average of 25 cents per bushel, a difference of 100 per cent in favour of feeding it.

TABLE XXIII.

—	Amount of barley consumed each month by the two swine.	Gain in pounds of pork each month.	Return per bushel of barley fed.	Pounds of barley consumed for one pound of pork.		Weight of swine at the end of month.
	Lbs.	Lbs.	Cts.	Lbs.	oz.	Lbs.
First month	288	83	69	3	7	200
Second "	335	71	50	4	11	271
Third "	370	65	42	5	11	336
Fourth "	341	62	43	5	8	398

Summary.—It took an average of 4 pounds 11 ounces of barley during the four months to make 1 pound of pork. Average return per bushel of barley fed, 50 cents.

SPELTZ (EMMER) COMPARED WITH MIXED GRAIN.

In 1903, Mr. S. A. Bedford, at Brandon, fed three lots of four pigs each, Yorkshire and Berkshire, one lot on speltz and the other lot on a ration composed of one-fifth oats, two-fifths wheat screenings and two-fifths barley; all feed ground.

Both kinds of feed were valued at 75 cents per hundred pounds. Reports have been received of injury to young pigs from feeding speltz, but no difficulty was experienced from this cause here.

At the close of the test the pigs were sold at $5.25 per hundred pounds, live weight.

Ration fed.

Amount and value of food consumed during the fattening term of 81 days from January 15 to April 9, 1903:—

TABLE XXIV.

—	Grain fed.	Value of Feed.
	Lbs.	$ cts.
Pen 1, fed speltz	1,525	11 43
Pen 2, fed mixed grain	1,550	11 62

Summary.

—	Weight when bought.	Value when bought.	Weight when sold.	Value when sold.	Value of food.	Profit on each pen.
	Lbs.	$ cts.	Lbs.	$ cts.	$ cts.	$ cts.
Pen 1, fed speltz	432	22 68	821	43 10	11 43	8 99
Pen 2, fed mixed grain	402	21 10	809	42 47	11 62	9 75

EXPERIMENT WITH LAMB'S QUARTER SEED AS PIG FEED AT BRANDON.

This test was made to ascertain whether a ration composed partly of lamb's quarter seed, *Chenopodium album,* had any advantage over a pure grain ration.

The lamb's quarter seed was boiled, and then after being well mixed with the chopped grain was fed wet. The grain was a mixture composed of one-half oats and quarter each of barley and wheat screenings.

The four pigs used for this test were Tamworth crosses. They were fed 76 days, and sold at $5.50 per hundred pounds, live weight.

From the result of this experiment it would appear that lamb's quarter seed has a limited value as food for pigs. The annual report of the Experimental Farms for 1899, page 147, contains an analysis of this seed.

Ration fed.

Amount and value of food consumed by each pen during the 76 days of the test. The grain is valued at 75 cents per hundred pounds:—

TABLE XXV.

—	Lamb's Quarter Seed.	Gain.	Value of feed.
	Lbs.		$ cts.
Pen 1, fed Lamb's Quarter Seed.....	216	950	7 12
Pen 2, without " "	.....	1,125	8 43

Summary.

—	Weight when bought.	Value when bought.	Weight when sold.	Value when sold.	Value of food.	Profit per pair.
	Lbs.	$ cts.	Lbs.	$ cts.	$ cts.	$ cts.
Pen 1, fed Lamb's Quarter Seed..... .	337	18 53	558	30 69	7 12	5 04
Pen 2, without " "	337	18 53	567	31 18	8 43	4 22

FURTHER EXPERIMENTS WITH DIFFERENT KINDS OF GRAIN FED IN DIFFERENT WAYS.

A large number of experiments have been conducted with the view of determining the relative and actual values of some of the feeding stuffs available to the average feeder. No positive values may be assigned to any food as a pork producer, but the average of a large number of experiments, some of them involving a good many animals of different weights and breeding, may be taken as a fairly good indication of the values of the grains or feeds tested.

To economize space, as many results as possible have been placed in the subjoined table.

The numbers are prefixed for reference merely.

All wheat fed was more or less injured by frost. It will be observed that the wheat when fed whole and soaked gave rather poorer results than when fed ground and soaked. The comparatively large amount of wheat required for a pound of increase in experiments 1, 2 and 3 exemplifies very clearly the disadvantage of feeding swine after a weight of 175 to 200 pounds has been attained. This is seen very clearly when we compare lots 2 and 3 with lots 4 and 8. In lot 2 where swine weighing 186 pounds to begin with were fed, an average of 6·59 pounds was required to produce 1 pound of pork, while in lot 4, where the pigs weighed 61 pounds to begin with, only 4·23 pounds feed was required for the same increase. Of course it will be observed that in lot 2 the wheat was fed whole while it was ground in lot 4, the difference in the amounts of grain required, however (2·36 pounds), is much too great to be accounted for in this way.

A comparison of experiments 4 and 5 shows the value of skim-milk to be about one-seventh of the frozen wheat, pound for pound.

In comparing experiments 8 and 9, however, it will be seen that skim-milk is apparently worth one-fifth as much as the mixture of barley, rye, wheat and bran. This is explained by the smaller proportion of skim-milk in the ration. (See page ...)

Experiments 8 and 9 exemplify the importance of feeding a mixed ration as a means of economizing feed.

TABLE XXVI.

Experiment.	Feed.	How Prepared.	No. of Swine.	Average weight at start.	Average weight at finish.	Average net gain.	Number of days fed.	Average daily gain.	Average amount feed eaten.	Average amount feed for 1 lb. gain.	Per cent dressed weight.
				lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	p.c.
1	Oats	Whole, soaked 54 hrs.	4	97	170	73	84	·87	307	4·21	74·67
	Skim-milk								252	3·45	
2	Oats	Ground, soaked 54 hrs.	4	54	184	130	126	1·03	424	3·26	74·87
	Skim-milk								756	5·81	
3	Barley	Ground, soaked 54 hrs.	4	73	184	111	112	1·00	483	4·35	74·56
4	Barley	Whole, soaked 54 hrs.	4	99	199	100	84	1·19	364	3·64	74·19
	Skim-milk								252	2·52	
5	Corn	Ground, soaked 30 hrs.	4	74	172	98	112	·87	408	4·16	76·89
6	Corn	Whole, soaked 54 hrs.	3	72	190	118	91	1·30	343	2·90	81·74
	Skim-milk								273	2·31	
7	Pease	Whole, soaked 54 hrs.	4	100	207	107	84	1·27	356	3·33	75·43
	Skim-milk								252	2·35	
8	Pease	Ground, soaked 54 hrs.	4	62	224	162	126	1·28	446	2·76	76·07
	Skim-milk								756	4·68	
9	Oats and pease	Ground, soaked 54 hrs.	3	61	226	165	126	1·31	508	3·00	75·15
	Skim-milk								756	4·51	
10	Oats, barley and pease.	Whole, soaked 54 hrs.	3	71	176	105	91	1·15	306	3·20	79·08
	Skim-milk								273	2·60	
11	Shorts	Soaked 36 hrs.	4	72	156	84	112	·75	372	4·42	77·73
12	Meal	Soaked 30 hrs.	5	60	175	115	84	1·37	349	3·10	77·79
	Skim-milk								504	4·35	
13	Meal	Soaked 30 hrs.	5	61	154	93	84	1·11	179	1·92	74·40
	Skim-milk								504	5·40	
	Sunflowers	Soaked.							197	2·11	
14	Potatoes	Raw	3	56	153	97	140	·70	133	1·37	76·58
	Meal	Soaked 30 hrs							365	3·72	
	Skim-milk								105	1·08	
15	Potatoes	Cooked	3	56	171	115	140	82	831	7·18	
	Meal	Soaked 30 hrs							177	1·52	
	Skim-milk								315	2·72	
16	Potatoes	Raw	3	55	192	137	140	·98	98	·71	76·99
	"	Cooked							332	2·41	
	Meal	Soaked 30 hrs.							314	2·28	
	Skim-milk								210	1·52	
17	Potatoes	Cooked	3	55	195	140	140	1·00	712	5·06	
	Meal								289	2·05	
	Skim-milk								105	·74	
18	Potatoes	Cooked	3	50	192	142	140	1·01	1,034	7·29	78·39
	Meal								140	·98	
	Skim-milk								420	2·96	
19	Oats, pease and barley.	Ground, soaked 30 hrs.	4	66	190	124	119	1·04	467	3·76	
20	¾ oats, pease and barley.	Ground and soaked	4	68	137	69	119	·58	247	3·60	
	¼ clover								82	1·20	

Meal in each case in the above tables means a mixture, equal parts by weight, of barley, rye, frozen wheat and bran, the first three being ground.
of barley, rye, frosen wheat and bran, the first three being gronud.

GREEN FEEDS AND PASTURES.

EXPERIMENTS WITH RAPE.

A great many pigs are fed annually on rape on the Experimental Farm at Ottawa. The following record is submitted to illustrate the part taken by rape in pork production. In one instance six pigs were pastured from August 14 till snow in 1900 on three-sixteenths of an acre of rape.

LOT OF SIX PIGS ON RAPE PASTURE.

TABLE XXVII.

No. of Pig.	Weights.							
	Aug. 14.	Aug. 28.	Sept. 11.	Sept. 25.	Oct. 9.	Oct. 16.	Oct. 30.	Dec. 6.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
279	61	76	80	85	96	108	129	175
280	60	73	80	95	105	121	147	195
281	64	73	91	103	111	127	150	201
282	60	73	90	99	109	120	143	171
283	60	72	82	99	114	135	157	203
284	53	68	76	90	105	118	141	182
Total	358	435	499	571	640	729	867	1,127
Total gain	.....	87	64	72	69	89	138	260
Daily rate of gain in lbs	.....	1·03	0·76	0 85	0·82	2·12	1·64	1·20
Daily grain ration	.....	1	1½	1¾	2	3	4	5

During the latter part of November and December the pigs had no rape.

A study of the above table shows that to produce 100 pounds of pork only 269 pounds of meal was required in addition to the rape. The average amount of meal required for 100 pounds of pork is 425 pounds. The use of rape, therefore, saved 156 pounds of meal, saved by three-sixteenths of an acre of rape. All pig weights mentioned are live weights.

Many other lots have been fed similarly with similar results. In 1902 sixty pigs were fed on an acre and a half. In addition to the rape pasture, about 500 pounds of meal were required for each pig from weaning time to an average of 185 pounds live weight in October or November.

THE JERUSALEM ARTICHOKE.

(Helianthus tuberosus.)

A plant that is attracting some attention as yielding a plentiful supply of succulent and apparently rather nutritious food for pigs is the Jerusalem Artichoke. Its value would, however, appear to be lessened by the great length of time required to mature the tubers or even produce them in any considerable bulk at the base of a plant.

A plot of one-sixteenth of an acre (10 square rods) in area was sown May 19, with about 70 pounds of tubers. They were planted four inches deep, in rows 24 inches

apart, and in hills about 20 inches apart in the rows. They required but little cultivation, as they soon grew so dense as to kill all other or less vigorous forms of plant life. The growth of the plant for about three months was confined to the stem, leaves and roots alone, no appreciable development of tubers being observable. In September young tubers made their appearance and slowly developed.

On October 3 only small tubers about the size of a hen's eggs were found on digging, although the plants had made a most luxuriant growth, standing 10 to 13 feet high, and about 50 per cent of them being in flower.

Although the tubers were immature, it was decided, in view of the lateness of the date, to turn the pigs in at once. Accordingly on the above-mentioned date six crossbred pigs were turned free in the lot. They were allowed 1½ pounds of meal each per diem in addition to the artichokes, which they rooted out most industriously and ate most greedily. I have never seen pigs eat anything with more gusto.

The following table will give an idea of the progress made by this lot of pigs while on artichokes as a supplementary food for pigs:—

TABLE XXVIII.

No. of Pig.	Weight, Oct. 3.	Weight, Oct. 24.	Gain.	Daily rate of Gain.	No, of Pig.	Weight, Oct. 3.	Weight, Oct. 24.	Gain.	Daily rate of Gain.
	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.
263	100	131	31	1·47	269	109	145	36	1·71
264	105	141	36	1·71	271	95	127	32	1·52
267	106	138	32	1·52					
268	111	141	30	1·42	Total	626	823	197	1·57 Average

The daily average of 1·57 pounds is remarkable in pigs of such live weights, but becomes still more worthy of consideration when we remember the small amount of grain fed per diem.

During the twenty-one days the 6 pigs consumed 189 pounds of meal (one-half corn, one-half oats, pease and barley equal parts), at 90 cents per cwt., $1.70, while the meat produced, valued at current prices ($6.25 per cwt.), was worth $12.31, leaving a balance of $10.61 for the sixteenth of an acre of artichokes. Putting this in another way, we have 197 pounds of pork produced at a cost as follows:—

189 pounds meal at 90 cents		$1 70
One-sixteenth acre artichokes, cost for seed	$0 50	
For planting, &c	1 00	
Rent, $5 per acre	0 35	
		1 85
Net cost		$2 25

That is, one pound of pork produced at a cost of 1·8 cents.

This tuber may be sown in the autumn, and will then start to grow early the next year, or the crop may be left unharvested till the ensuing spring, and pigs allowed to root them out as soon as the frost comes out.

EXPERIMENTS WITH ROOTS.

In each case the meal mixture fed consisted of one-half corn, the other half oats, pease and barley, equal parts. In addition, each pig was given three pounds of milk daily, and all the roots they would consume, as follows:—

Lot 1.—Turnips fed pulped.

Lot 2.—Mangels fed pulped.
Lot 3.—Sugar beets grown for forage fed pulped.
Lot 4.—Sugar beets grown for sugar production fed pulped.

LOT 1—MEAL, MILK, TURNIPS.

Number of pigs in test	4
Aggregate weight, January 7	405 lbs.
Average weight, January 7	101 "
Aggregate weight April 23	768 "
Average weight April 23	192 "
Aggregate gain	363 "
Average gain	91 "
Daily rate of gain per pig for 106 days	·85 "
Pigs ate 780 lbs. meal at 90 cents per cwt	$ 7 02
" ate 3,808 lbs. mangles at 10 cents per cwt	3 81
" ate 1,284 lbs. skim milk at 20 cents per cwt	2 57
Total	$13 40

Cost to produce pork was:—

405 lbs. feeders at $7 per cwt	$28 35
Food consumed, value	13 40
Total cost	$41 75
Sold 768 lbs. pork at $6 per cwt	$46 08
Profit on lot of 4 pigs	4 33
Cost to produce 100 lbs. increase live weight	3 69

Buyer's report:—

4 pigs—all 'select.'

Packer's report on carcasses:—

No. 312, weighed alive, 197 lbs.; dressed, 133 lbs.; graded; good; firm.
No. 313, weighed alive, 197 lbs.; dressed, 135 lbs.; graded; hard; firm.
No. 314, weighed alive, 189 lbs.; dressed, 126 lbs.; graded; hard; firm.
No. 315, weighed alive, 185 lbs.; dressed, 121 lbs.; graded; good; firm.

LOT 2—MEAL, MILK, MANGLES.

Number of pigs in test	4
Aggregate weight January 7	377 lbs.
Average weight January 7	94 "
Aggregate weight April 23	766 "
Average weight April 23	191 "
Aggregate gain	389 "
Average gain	97 "
Daily rate of gain per pig	·90 "
Pigs ate 786 lbs. meal at 90 cents per cwt	$7 07
" ate 5,930 lbs. mangels at 10 cents per cwt	5 93
" ate 1,284 lbs. skim milk at 20 cents per cwt	2 07
Total	$15 57

Cost to produce pork was:—

377 lbs. feeders at $7 per cwt	$26 39
Food consumed	15 57
Total cost	$41 96
Sold 766 lbs. pork at $6 per cwt	$45 96
Profit on lot of 4 pigs	4 00
Cost to produce 100 lbs. increase live weight	4 00

Buyer's report:—

4 pigs—all 'select.'

Packer's report:—

No. 319, weighed alive, 195 lbs.; dressed, 135; graded; good; firm.
No. 317, weighted alive, 195; dressed, 138 lbs.; graded; good; firm.
No. 318, weighed alive, 182; dressed, 125 lbs.; graded; good; firm.
No. 319, weighed alive, 194 lbs.; dressed, 131; graded; good; firm.

LOT 3—MEAL, MILK, FORAGE, SUGAR BEETS.

Number of pigs in test	4
Aggregate weight January 7	307 lbs.
Average weight January 7	77 "
Aggregate weight April 23	807 "
Average weight April 23	202 "
Aggregate gain	500 "
Average gain	125 "
Daily rate of gain per pig, 106 days	1·18 "
Pigs ate 793 lbs. meal at 90 cents a cwt	$ 7 13
" ate 4,298 lbs. sugar beets at 15 cents per cwt	6 44
" ate 1,284 lbs. skim milk at 7 cents per cwt	2 57
Total	$16 14

Cost to produce pork was.—

307 lbs. feeders at $7 per cwt	$21 49
Food consumed	16 14
Total cost	$37 63
Sold 807 lbs. pork at $6 per cwt	$48 42
Profit on lot of 4 pigs	10 79
Cost to produce 100 lbs. increase live weight	3 22

Buyer's report:—

3 pigs, 'select,' 1 'fat.'

Packer's report:—

No. 320, weighed alive, 175 lbs.; dressed, 118 lbs.; graded; medium; a little too thin.
No. 321, weighed alive, 218 lbs.; dressed, 155 lbs.; graded; very good; a little too fat.
No. 322, weighed alive, 187 lbs.; dressed, 155 lbs.; graded; very fair.
No. 323, weighed alive, 287 lbs.; dressed, 157 lbs.; graded; very firm; right thickness of fat.

LOT 4—MEAL, MILK, SUGAR BEETS—(*Special Culture*).

Number of pigs tested	4
Aggregate weight January 7	228 lbs.
Average weight January 7	57 "
Aggregate weight May 25	754 "
Average weight May 25	188 "
Aggregate gain	528 "
Average gain	132 "
Daily rate of gain per pig for 138 days	·95 "
Pigs ate 1,030 lbs. meal at 90 cents per cwt	$ 9 27
" ate 4,266 lbs. sugar beets at 15 cents per cwt	6 39
" ate 1,680 lbs. skim milk at 20 cents per cwt	3 36
Total	$19 02

Cost to produce pork was.—

228 lbs. feeders ate $7 per cwt	$15 96
Food consumed	19 02
Total cost	$34 98
Sold 754 lbs. pork at $6 per cwt	$45 24
Profit on lot of 4 pigs	10 26
Cost to produce 100 lbs. increase live weight	3 60

Buyer's report:—

4 pigs all 'select.'

No packer's report on carcasses.

BROME GRASS PASTURE FOR PIGS.

In 1900, Mr. S. A. Bedford, at Brandon, fed Chester Tamworths cross pigs on brome grass pasture.

The pasture field was seeded to brome grass in August, 1898. The area was one acre, and it not only gave abundance of pasture for the four pigs, but about two tons of hay was saved in addition. The pigs were evidently very fond of the grass, and were found feeding on it at all times of the day.

For the first three months both lots were fed on a mixture of soaked ground grain, composed of half oats, quarter barley and quarter wheat screenings, and during the last three months on ground peas alone.

The penned animals were fed all the grain they would eat up clean, but the pastured pigs only received sufficient to keep them steadily gaining in flesh without making them independent of the pasture.

Cost of Grain Fed to Pigs in Pasture.

156 pounds of barley at ½ cent per pound	$ 0 78
156 pounds of wheat screenings at ½ cent per pound	0 78
312 pounds of oats at ¾ cents per pound	2 34
325 pounds of peas at 1 cent per pound	3 25
	$ 7 15

Cost of Grain Fed to Pigs without Pasture.

231 pounds of barley at ½ cent per pound	$ 1 15
231 pounds of wheat screenings at ½ cent per pound	1 15
462 pounds of oats at ¾ cents per pound	3 46
425 pounds of peas at 1 cent per pound	4 25
	$10 01

SUMMARY.

Pastured pigs—	Dr.	Cr.
First cost of pigs, 117 pounds at 4½ cents	$ 5 26	
Cost of feed	7 15	
Sold 510 pounds at 4½ cents		$22 95
Profit on four pigs	10 54	
	$22 95	$22 95

Without Pasture—	Dr.	Cr.
First cost of pigs, 115 pounds at 4½ cents	$ 5 17	
Cost of feed	10 01	
Sold 481 pounds at 4½ cents		$21 64
Profit on pigs	6 46	
	$21 64	$21 64

POTATOES AND TURNIPS AS PIG FEED.

Experiment at Brandon, 1902.

Potatoes and turnips give large returns in this country, and if found profitable for pig feed, this quantity grown could be greatly increased.

Four pigs were used for this test—two pure-bred Yorkshires and two Yorkshire Tamworth crosses. In the test each pair consisted of one pure-bred and one cross-bred animal.

The grain mixture used was composed of one-half barley and one quarter each of oats and wheat screenings, valued at 75 cents per hundred pounds. With this was fed a mixture of two-thirds small potatoes and one-third turnips, which are valued at 20 cents per bushel. These were boiled, mashed and mixed with the ground grain.

It would appear from this test that potatoes and turnips can be used to replace a portion of the grain ration, but they are worth less than 20 cents per bushel for that purpose.

RATION fed during the fattening term of 82 days, from August 28 to November 18:—

TABLE XXIX.

—	Grain fed.	Value.	Roots fed.	Value.	Total value of food.
	Lbs.	$ cts.	Lbs.	$ cts.	$ cts.
Pen 1, fed roots	728	5 46	846	2 88	8 28
Pen 2, without roots	978	7 33	....	.....	7 33

SUMMARY.

—	Weight when bought.	Value when bought.	Weight when killed.	Value when killed.	Value of food.	Profit on each pair.
	Lbs.	$ cts.	Lbs.	$ cts.	$ cts.	$ cts.
Pen 1, fed roots	171	10 26	372	22 32	8 28	3 78
Pen 2, without roots	177	10 62	372	22 32	7 33	4 37

STOCK FOODS FOR PORK PRODUCTION.

In August, 1904, 32 pigs, ranging in weight from 43 to 80 pounds were divided into eight groups of four pigs each, and for the next 90 days fed experimentally. In each case the individuals in a group were nearly uniform in size. The groups, however, showed considerable difference in their total weights, the heaviest group weighing 300 pounds, or 75 pounds per pig, while the lightest group weighed 180 pounds, or 45 pounds per pig. It was not possible to secure a more uniform lot at the time, and it was considered better to have considerable difference in the total weights of the lots rather than to have some large and some small pigs in each lot.

The experiments lasted 90 days. During that time pigs were confined in pens with small floored yards attached. Lots 7 and 8, however, were outside, lot 7 having a small unfloored yard and a cabin wherein to sleep, while lot 8 had a clover pasture of about one-eighth of an acre and a cabin wherein to sleep.

The results speak for themselves, but it will be noticed that all supplementary foods fed other than skim-milk and pasture, had the effect of raising the cost of production. Skim-milk, on the contrary, lowered the cost very materially, and pasture had a similar effect in a lesser degree. The meal used was a mixture of half shorts and half mixed grains, oats, pease and barley.

In estimating the cost of production, the meal ration is valued at $1 per 100 pounds, the skim-milk at 15 cents per 100 pounds, and the supplementary foods or stock foods at the cost of the same on the Ottawa markets, viz.: Anglo-Saxon stock food, 10 cents per pound; International stock food, 15 cents per pound; Herbageum 12½ cents per pound, and sugar and flax 2½ cents per pound. Pasture is not valued, but its value may be deduced from the data given.

TABLE XXX.

STOCK FOODS FOR PORK PRODUCTION.

Lot	1	2	3	4	5	6	7	8
Description of ration	Meal, Inside.	Meal, Anglo-Saxon Stock Food.	Meal, International Stock Food.	Meal, Sour skim-milk.	Meal, Herbageum.	Meal, Sugar and Flax.	Meal, Outside.	Meal, Pasture Clover and Rape.
No. of pigs	4	4	4	4	4	4	4	4
No. of days on feed	90	90	90	90	90	90	90	90
Total weight to start	300 lbs.	206 lbs.	208 lbs.	180 lbs.	220 lbs.	240 lbs.	204 lbs.	250 lbs.
Average weight to start	75 "	51½ "	52 "	45 "	55 "	60 "	51 "	62½ "
Total weight at end of experiment	725 "	565 "	541 "	612 "	673 "	711 "	657 "	653 "
Average weight at end of experiment	181¼ "	141¼ "	135¼ "	153 "	168 "	178 "	164 "	163 "
Amount meal eaten	1,860 "	1,551 "	1,456 "	1,275 "	1,781 "	1,880 "	1,942 "	1,741 "
Amount other food	.....	80 "	42 "	1,335 "	45 "	322 "	.....	Pasture.
Total gain of lot in 90 days	425 lbs.	359 "	333 "	432 "	453 "	471 "	453 lbs.	413 lbs.
Amount meat required for 100 lbs. gain	438 "	432 "	437 "	295 "	393 "	399 "	431 "	421 "
Amount other food for 100 lbs. gain	.....	22 "	12 "	309 "	10 "	68 "	.....	Pasture.
Cost of 100 lbs. gain	$4.38	$6.52	$6.17	$3.42	$5.15	$5.69	$4.31	$4.21
Daily rate of gain per pig	1·171 lbs.	1·00 lbs.	·925 lbs.	1·20 lbs.	1·25 lbs.	1·31 lbs.	1·25 lbs.	1·15 lbs.
Total gain per pig in 90 days	106¼ "	89¾ "	83¼ "	108 "	113¼ "	117¾ "	113¼ "	103½ "

The Anglo-Saxon Stock Food, the International Stock Food and Herbageum were all fed according to manufacturers' directions both as to quantity to feed and method of feeding.

DEPARTMENT OF AGRICULTURE
CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

INSECTS

INJURIOUS TO GRAIN AND FODDER CROPS, ROOT CROPS AND VEGETABLES

BY

JAMES FLETCHER, LL.D., F.R.S.C., F.L.S.

Entomologist and Botanist to the Dominion Experimental Farms.

BULLETIN No. 52

JUNE, 1905

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont

DEPARTMENT OF AGRICULTURE
CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

INSECTS

INJURIOUS TO GRAIN AND FODDER CROPS, ROOT CROPS AND VEGETABLES

BY

JAMES FLETCHER, LL.D., F.R.S.C., F.L.S.

Entomologist and Botanist to the Dominion Experimental Farms.

BULLETIN No. 52

JUNE, 1905

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

To the Honourable
The Minister of Agriculture.

SIR,—I have the honour to submit herewith for your approval Bulletin No. 52 of the Experimental Farm series, which has been prepared under my direction by Dr. James Fletcher, Entomologist and Botanist of the Dominion Experimental Farms. This bulletin treats of insects injurious to grain and fodder crops, root crops and vegetables.

The injuries annually caused by insects to farm crops seriously reduce the profits arising from the labour of the farmer. Much of this loss is preventable and the object of this bulletin is to supply that practical information which will enable the reader to deal with these several pests in the most effective manner and at the least cost. The concise accounts given of the life history and habits of the injurious species treated of, together with the illustrations, will provide the means whereby they may be readily distinguished. The remedies suggested for the destruction of these pests are as a rule of easy application and at the same time are very effective.

It is hoped that farmers generally will put into practice the useful information here given, and, whenever occasion arises, promptly apply the remedies named, and thus much loss may be prevented.

I have the honour to be, Sir,

Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, June 30, 1905.

INSECTS INJURIOUS TO GRAIN AND FODDER CROPS,

ROOT CROPS AND VEGETABLES

By James Fletcher, LL.D., F.R.S.C., F.L.S.

Entomologist and Botanist to the Dominion Experimental Farms.

Every crop grown by the farmer and gardener is liable to be attacked and reduced in value by various insect enemies, from the time the seed is sown until it is harvested. Frequent inquiries concerning even the commonest and most injurious pests make it advisable to issue in concise form for reference, an account of some of the more important of these, together with the latest approved remedies, and the most convenient methods of applying them.

The present bulletin treats of those insects which are injurious to grain and fodder crops, roots and vegetables; and it is the intention to treat of other classes of injurious insects in subsequent bulletins.

It must be acknowledged by all observant people that the losses due to the attacks of insects are every year enormous; and it should be more widely known that there are practical—that is effective, cheap and easily applied—remedies for most of those kinds which year by year levy such a heavy tax on all crops. For the effective use of remedies against injurious insects, a certain amount of knowledge as to the habits and structure of the latter is very useful, so that the most appropriate remedy may be made use of, and this at the time when it will be most effective.

LIVES OF INSECTS.

The lives of insects are divided into four well marked stages. These are: (1) the egg; (2) the larva (caterpillar, grub or maggot), during which, as a rule, they are most injurious; (3) the pupa or chrysalis, in which, except in a few orders, they do not feed, and are, as a rule, without the power of locomotion; and (4) the perfect insect. Although most insects are injurious in one or two stages, only some are destructive in all three of their active stages. It therefore becomes important to learn their appearance and habits from the time the eggs are laid until the whole life history is completed, so that no opportunity of destroying them may be lost.

Biting and Sucking Insects.—All insects may be divided into two large classes, by the nature of their mouth parts. In the first or larger division, Biting Insects, they are furnished with mandibles or biting jaws, by means of which they consume the substance of their food, as in the case of caterpillars, beetles, grasshoppers, &c. In the second class, Sucking Insects, they have, instead of mandibles, a beak or tube by means of which they suck up their food in a liquid form from beneath the surface, as in the case of the true bugs, plant-lice, scale insects, mosquitoes, &c.

PART I.

REMEDIAL MEASURES.

NATURE OF ATTACK.

When insects are observed to be injuring a crop, an examination should at once be made to discover the nature of the injury, so as to decide upon the proper remedy. It is plain that with Biting Insects, which bite off and swallow parts of the plant attacked, all that is necessary is to place upon the food plant some poisonous substance which will not injure the plant, but which being eaten by the insects attacking it, will kill them. With Sucking Insects, however, this treatment would be useless, for they would push their beaks through the poisonous covering on the outside of the food plant, and would with impunity suck up the sap upon which they live, from beneath the surface. For Sucking Insects, therefore, some substance must be used which will kill by mere contact with their bodies, or by suffocating them.

For nearly all the kinds of injurious insects which attack our staple crops, we have now good practical remedies; and all that is necessary for a farmer or gardener who sees that his crops are being injured by insects is to write at once to the Division of Entomology, at the Central Experimental Farm, Ottawa, stating plainly what the trouble is, and, whenever possible, sending specimens for examination. In most cases, useful advice can be sent back at once, by which much loss will be prevented, because those insects which are most injurious to crops are naturally common species, and the life histories of nearly all of these have been worked out, and already practical remedies have been discovered.

There is at the present time in North America a large and earnest body of students working at problems connected with the discovery of new remedies or the improvement of old ones, by means of which insects which injure crops may be controlled. Something new is being learnt every day as to the means of either making or applying remedies, and day by day new facts are being learnt concerning the life histories and habits of the insects which are the causes of loss. In the present bulletin an effort has been made to supply Canadian farmers with the best remedies and the latest developments in methods of applying them. So much is written nowadays in magazines, newspapers, &c., concerning insect injuries and the best ways of preventing them that a great many experiments have been necessary to find out how reliable some of the proposed remedies were, and the present bulletin gives only the best results of such experiments as have been actually tried by officers of the Division of Entomology.

APPARATUS.

Nearly all insecticides may be used both as dry powders or in liquid. In the case of the useful arsenical poisons, it is necessary to mix them with some other substance as a diluent, on account of their caustic action upon tender vegetation, and also for convenience of distribution and to economise the material. For dry applications, suitable diluents will be found in flour, land-plaster, air-slaked lime, finely sifted ashes, or even road dust. The important point is that the powder shall be perfectly dry and in a very fine state of division, so as to mix thoroughly with the insecticide and thus insure even distribution. There are several implements for distributing dry insecticides such as bellows, insect guns, dusting boxes, &c., many of which will be found mentioned in the catalogues of our leading seedsmen. A convenient method for distributing dry poisons is to place the powder in a small bag of very fine muslin, then tie this to the end of a short stick so that it swings freely. If the bag is tapped lightly

with another stick held in the other hand, the operator can walk erect and do much better work than by stooping along over his crop with an aching back. Dry mixtures should be applied in still weather and, if possible, when the plants are wet with dew. It is found by experience, however, that during the spring months when insecticides are most needed, there are often periods of several days when these conditions do not occur. It therefore becomes necessary to apply the poison in some other way, so that the material may be evenly distributed over the plant to be protected, and not blown away by the wind. For this purpose, mixing with water and then applying with a spraying pump is the most convenient plan.

I have no doubt that it will repay any one who has to apply insecticides, even in a small garden, to go to the expense of procuring a pair of proper bellows for dry mixtures and a force pump with a spraying nozzle for liquid applications. Makeshift contrivances, such as watering cans, whisks, and even bunches of leaves, which are frequently used, actually cost far more in wasted time and materials than would pay for the best special implements, in addition to which, when the work is done, it is neither satisfactory nor effective. There are a great many kinds of implements for distributing both dry and liquid insecticides, many of which are advertised in the agricultural and horticultural papers.

Pumps.—Before deciding on what kind to use, it is advisable for one who has not used these implements to consult his neighbours who have done so, and then write for catalogues to the best known makers; and when buying make it a general principle always to procure the most suitable and the best of its kind. The difference in the initial cost between a poor, cheap implement and a thoroughly good one is small, compared with the subsequent loss and inconvenience from using a cheap pump or a poor nozzle. Spraying pumps are made in four sizes: (1) hand pumps, suitable for small gardens, which can be procured at prices ranging from $2 to $5; (2) larger pumps mounted on wheels or suitable for loading on a stone-boat, and consisting of an ordinary 40-gallon barrel, with a strong force pump to be worked by hand, which will cost about $20, and will be all that is required in an orchard of from fifty to a hundred trees, or in a large garden; (3) knapsack sprayers, which are useful machines, consisting of a tank of about four gallons' capacity, to be carried on the back, and useful when treating outbreaks of cutworms, turnip aphis, &c., in field practice; (4) power machines; these are of various kinds, and are for use in large plantations, or for spraying street trees where great power is required to elevate the spray. These are worked by steam, by being geared to the wheels of the vehicle on which the tank is drawn, or by the escape of carbonic acid gas. The cost of these will vary very much according to the make and size of the machines.

Spraying nozzles.—Of equal importance with a proper force pump in distributing liquid poisonous applications is a suitable nozzle, by means of which the liquid can be distributed evenly. The late Professor Riley, who did much in the development of spraying machines, said: 'The desiderata in a spraying nozzle are: the ready regulation of the volume to be thrown, the greatest atomizing power with the least tendency to clog, facility of cleansing or separation of its component parts, cheapness, simplicity and adjustability to any angle.'

Almost every maker of spraying nozzles has some special make which he recommends; but many kinds now in the market have not the qualities necessary for spraying crops for injurious insects in the best way. All that can be said here, is that some of these nozzles are far better than others and that great care is necessary in choosing one which will come up to Dr. Riley's requirements, as mentioned above. The experience of others is a valuable guide in this work; and, both at the Dominion Experimental Farms and at the similar provincial institutions, spraying work is carried on every year, which can be witnessed by all who wish to do so, and advice will be freely given by the officers in charge.

The operation of 'spraying' consists of applying liquids by means of a force pump and spraying nozzle with such force as to break up the liquid so thoroughly that

it falls upon the plants treated as an actual mist or spray. Such terms as *sprinkling* o *showering* are inaccurate for the operation here intended. Unfortunately, much of the so-called spraying as usually carried out could more accurately be designated by these terms, which describe a much less careful and less even distribution of liquids.

REMEDIES.

Remedies are either Preventive or Active, and must be applied in accordance with the circumstances of the case and the habits of the attacking insects. *Preventive remedies* are either agricultural or deterrent. The former of these consist chiefly of such methods as special rotation of crops, high culture, so as to stimulate a healthy growth of the crop and keep the land free of weeds and rubbish; early and late seeding, so as to present a crop to its insect enemies when they appear, in such condition that they cannot injure it, and rotation of crops, by which insects attracted to a locality by a crop will not have in that place the same crop to feed upon the following year. Deterrent preventive remedies consist of the application of mechanical contrivances, such as bands of paper or tin placed round plants to prevent cutworms getting at them, or the destroying or masking of the natural odours of some plants by scattering amongst them substances possessed of a stronger or a disagreeable odour, like gas-lime, carbolic acid, &c. *Active remedies* include such methods as hand-picking and the application of various poisonous substances to the plants to be protected.

For convenience of reference in the latter part of this bulletin, I append a short statement concerning each of the best known remedies, which will be referred to by the numbers which precede them:—

I. *Arsenites.*—The best known of these are Paris green, Arsenate of lead, the Arsenite of lime with soda, which has lately come into very much more general use, and Green Arsenoid.

In all of these poisons, arsenic is the essential ingredient, and other chemicals are mixed with the arsenic for the purpose of preventing it from injuring vegetation. There are many spraying compounds which contain arsenic, some of which are sold ready-made, and many others are made at home by combining the necessary ingredients.

Paris Green.—Undoubtedly the best known, and in many respects the safest poison to use is Paris green. It has passed through many years of trial, is well known, has a distinctive colour, and is a definite chemical compound containing 58·65 per cent of arsenious oxide, 31·29 per cent of copper oxide, and 10·06 per cent of acetic acid. It is, therefore, an aceto-arsenite of copper. It is soluble in ammonia. Paris green, if demanded, is now obtainable pure in all parts of Canada; but, as there is sometimes an adulterated article found in the market, it is wisest always to add an equal amount, with the Paris green, of freshly slaked lime, when the free arsenic will combine with the lime, and it can then be used safely at the rate of one pound of Paris green in 160 gallons of water on all vegetation, and, for a dry application, 1 pound Paris green in 50 pounds flour, land-plaster, slaked lime or some other perfectly dry powder.

As a general principle, lime should be always used with Paris green whenever it is applied in a liquid insecticide. Paris green is very heavy, and the particles quickly sink to the bottom of any liquid with which it is mixed. This makes constant stirring necessary. Paris green does not dissolve in water, and is merely mixed with water to facilitate its even distribution on vegetation in the very small quantities that are necessary to destroy insects. The finer the poison is ground, the quicker its effect on the insects which eat it, because the minute crystals are more rapidly dissolved by the digestive juices in the stomachs of the insects. The finer it is ground, the better also it will remain suspended in a liquid application. For most insects, one ounce of Paris green in 10 gallons of water is the standard strength; but some plants with coarse foliage, such as the potato, will stand double that strength.

Arsenate of Lead.—A poison which has come into much notice since the work of the Massachusetts Gypsy Moth Commission is Arsenate of Lead, which has been placed on the market in a very convenient form under the name of Bowker's Disparene and Swift's Arsenate of Lead. The chief advantages of Arsenate of Lead are that it can be applied to all kinds of foliage with less danger of injury than is the case with Paris green; and, on account of its fine state of division, it lasts longer on the foliage, because it does not wash off so easily. The cost of using it is about the same as that of Paris green, because, although cheaper, pound for pound, it is necessary to use three times the amount of it to get the same results. Arsenate of Lead may be made at home. Formulæ for its preparation vary slightly; but in the United States Division of Entomology, Bulletin No. 41, the following instructions are given for making the Arsenate of Lead wash ready for use:—

Arsenate of soda	10 ounces.
Acetate of lead	24 "
Water	150 to 200 gallons.

The arsenate of soda and acetate of lead should be dissolved separately and then poured into a tank containing the required amount of water. These chemicals unite readily, forming a white flocculent precipitate of lead arsenate, which is easily kept in suspension and can be used in excessive strengths on delicate plants without the addition of lime. When sprayed upon the foliage, it forms a filmy adhering coat, which is but little affected by ordinary rains.

Another formula for making Arsenate of Lead is that recommended by Prof. H. T. Fernald, and is :

Arsenate of soda, 50 per cent strength	4 ounces.
Acetate of lead	11 "
Water	150 gallons.

Put the arsenate of soda in two quarts of water in a wooden pail, and the acetate of lead in four quarts of water in another wooden pail. When both are dissolved, mix with the rest of the water. Warm water in the pails will hasten the process. Prof. Fernald recommends that in mixing this with Bordeaux mixture one gallon of the above should be mixed with fifty gallons of the mixture.

'*Arsenite of Lime with Soda:*—

White arsenic	1 pound.
Sal soda (crystal)	4 pounds.
Water	1 gallon.

'The ingredients are boiled in the required amount of water until dissolved, which will take place in a comparatively few minutes, after which the water lost by evaporation is replaced. To every 40 or 50 gallons of water a pint of this stock solution and from 2 to 4 pounds of fresh slaked lime are added. The chemical compound derived from the combination of the sal soda and the white arsenic is arsenite of soda. In the presence of lime this breaks down and arsenite of lime is formed. It requires 4·4 pounds of crystal sal soda, or 1·6 pounds of dry sal soda to combine with one pound of arsenic, and 2 pounds of freshly slaked lime to combine with one pound of arsenic to form arsenite of lime. It is always desirable to have an excess of lime present, in order to prevent all danger of burning; furthermore, this excess is a convenience to fruit growers, because they can see by the distribution and amount of lime on the foliage how well the spraying has been done. The formula, which is the Kedzie formula with a few minor changes, has been used in many different sections of the country with unvarying success. In all of the practical tests under the advice of the writer, this solution is used and is found to be, not only as efficient as other solutions, but far cheaper.

'When it is desired to use Bordeaux mixture with this solution, it is added to the Bordeaux mixture in the same proportion as to a similar quantity of water.'—*(C. B. Simpson, Bull. 41, U. S. Div. Ent.)*

The above combination of Arsenite of Lime with Soda is preferable to arsenite of lime on account of the difficulty in making this latter combination perfectly, and, when this is not the case, the free arsenic is very destructive to foliage.

London Purple, which is an impure arsenite of lime, is now very seldom used, for the same reason. As it is a waste product in the manufacture of aniline dyes, it is very variable in composition, and therefore unsafe to use.

Green Arsenoid.—This is a convenient poison to use, being practically Paris green not crystallized, and is in some ways better; being a very fine powder, it remains in suspension longer and adheres better to foliage. Its chief disadvantage is it has a rather larger percentage of soluble arsenic, and, unless mixed with fresh lime, as suggested for Paris green, there is danger of it injuring foliage. It may be used in the same proportion as Paris green, viz., one ounce to ten gallons of water.

II. *Kerosene Emulsions.*—Next in importance to the arsenites are the emulsions of kerosene. These are particularly valuable against such insects as plant-lice, scale insects, and animal parasites. The best formula is:—

Kerosene (coal oil)	2 gallons.
Rain water	1 gallon.
Soap	½ pound.

Boil the soap in the water till all is dissolved; then, while boiling hot, turn it into the kerosene, and churn the mixture constantly and forcibly with a syringe or force pump for five minutes, when it will be of a smooth, creamy nature. If the emulsion is perfect, it will adhere to the surface of glass without oiliness. As it cools, it thickens into a jelly-like mass. This gives the stock emulsion, which must be diluted with nine times its measure of warm water before using on vegetation. The above quantity of 3 gallons of emulsion will make 30 gallons of wash. Insects breathe through small openings along their sides. The effect of kerosene emulsion is to suffocate them, by stopping up these breathing pores.

Kerosene emulsions may also be made conveniently by using an equal amount of sour milk instead of soap and water in the above formula, and churning for the same time to get the stock emulsion. Recently another method has been suggested by Mr. F. T. Shutt and Mr. W. T. Macoun, of mixing kerosene first of all with flour and afterwards with water by churning the two together. This convenient plan is a modification of a method proposed by Prof. Close, of the Delaware Experiment Station, in which it was shown that lime has the power of holding kerosene in suspension and forming an emulsion which does not separate for a long time. Lime is not conveniently obtainable in all parts of Canada, and Mr. Shutt made the valuable discovery that flour, which is to be had everywhere, may be used with equally good results if the emulsion is to be used at once. This gives us, then, by far the most convenient kerosene emulsion, when small quantities are required for immediate use. Instructions for making this new flour kerosene emulsion are given in the May and June, 1905, issues of the 'Canadian Horticulturist.'

The preparation is simple. The requisite amount of kerosene is placed in a dry vessel and flour added in the proportion of eight ounces to one quart of kerosene. It is then thoroughly stirred and two gallons of water are added for every quart of kerosene; the whole is then vigorously churned for from two to four minutes, and the emulsion is ready for use. When required for immediate use, two ounces of flour will emulsify one quart of kerosene; but, on standing a few hours, the kerosene will separate. However, it has been further found by Mr. Shutt that, by scalding the flour before adding the kerosene, an excellent emulsion which does not separate in the least after one week, can be prepared with two ounces of flour, by mixing the resulting paste with one quart of kerosene and emulsifying with two gallons of water.

III. *White Hellebore.*—This is a vegetable poison, being the finely powdered roots of *Veratrum album.* It is useful for leaf-eating insects and root maggots. Although very poisonous to insects, owing to the poisonous principles being soluble, it can be safely used where the arsenites would be dangerous. It can be applied as a dry powder or as a liquid mixture, using one ounce to two gallons of warm water.

IV. *Insect Powder (Pyrethrum, Buhach).*—This is another vegetable insecticide of special value, from the fact that, although it is extremely active in its effects upon nearly all insects, it is practically harmless to human beings and the higher animals. It is the pulverised flowers of some plants belonging to the genus *Pyrethrum.* It is useful for many household pests, as flies, mosquitoes and wasps, all of which are quickly affected, either by having a small quantity thrown into the air of a room by means of an insect-gun or small bellows, or by a small quantity (a teaspoonful) being ignited and allowed to smoulder. It seems to have a marked effect upon the breathing organs of insects. Where practicable, a dry application gives the best results. If mixed with four times its weight of common flour, and then kept in a tightly closed vessel for twenty-four hours, the mixture will kill nearly all caterpillars it is applied to, and in this strength becomes the best remedy for the caterpillar of the Imported Cabbage Butterfly. It can also be used mixed with water, 1 oz. to 2 gallons of water.

V. *Soap Washes.*—The most effective soap wash is made with whale-oil soap, one pound to from four to six gallons of water. The term whale-oil soap is merely a trade name for a fish-oil soap, made with either potash or soda. The potash soaps, which are the best, because even strong solutions remain liquid when they cool, are soft soaps. The soda soaps are hard. Of the two, the potash soaps are considered the best to use on vegetation, as well as being more convenient. Both kinds should always be dissolved in hot water.

When bought at retail prices, these soaps cost from 15 to 20 cents per pound, according to the locality, but if obtained in large quantities, can be got at from 3 to 5 cents per pound. Fifty-pound kegs are supplied at 5 cents per pound. Two well known brands of potash soft soaps which have been much used in Canada, and have given good satisfaction, are those made by W. H. Owen, of Port Clinton, Ohio, and by Good & Co., of Philadelphia, Pa. If thought desirable, these soaps can be made at home; but it is very unpleasant and dirty work, and it is besides doubtful whether such good or cheap results can be secured as by buying from firms which make a special business of manufacturing soaps with only the required amount of moisture and the proper grade and amount of potash. It has been found in experiments carried on at Washington that what is required for spraying purposes is a caustic potash and fish-oil soap, made with a fairly good quality of fish-oil, and from which water has been eliminated by boiling, so that it does not exceed 25 or 30 per cent of the weight of the soap. Soaps made with caustic soda instead of caustic potash are unsuitable for spraying purposes. Dr. J. B. Smith, in his circular No. 5, 'Whale Oil Soap and its Uses,' says: 'Whale-oil, or fish-oil, soap is one of the most reliable materials for use against plant-lice, and generally against sucking insects which can be killed by contact insecticides. It kills by clogging the spiracles, or breathing pores, of the insects and also to some extent by its corrosive action. The advantages of fish-oil over ordinary laundry soap lie in the greater penetrating power, in the fact that it remains liquid when cold, at much greater strengths, and that fish-oil itself seems to be more fatal to insect life than other animal fats. A good soap can be made as follows:—

Concentrated potash lye	3½ lbs.
Water	7½ gallons.
Fish-oil	1 gallon.

Dissolve the lye in boiling water, and to the boiling solution add the fish-oil; continue to boil for two hours, and then allow to cool. Any grade of fish-oil will answer.'

Whale-oil soap may be applied in the strength of one pound in four gallons of water for brown or black plant-lice, and one pound in six gallons for green plant-lice; warm water should always be used when dissolving it.

Soaps of all kinds are very useful in adding adhesiveness to liquid mixtures when it is necessary to apply these to such vegetation as cabbages, turnips, peas, &c., which have their leaves covered with a waxy secretion which prevents water from lying upon them. Any kind of soap will answer for this purpose, and it may be remembered that one quart of soft soap is about equal to one pound of hard soap.

VI. *Carbolic Acid.*—This fluid is very valuable as a preventive remedy, owing to its permanent and characteristic odour, which is found to be distasteful to many insects. A convenient form of using it is the Cook wash, which is so effective against root maggots. This consists of boiling up one quart of soft soap, or one pound of hard soap, in a gallon of water. When boiling, add half a pint of crude carbolic acid. Boil for a few minutes and stir thoroughly. The mixture is then ready to be stored away for future use. When required, take one part of this mixture by measure to fifty of water, and sprinkle or spray directly upon the growing plants once a week from the time they appear above ground.

Carbolized Plaster, Sand, Ashes or Sawdust.—This is simply one pint of crude carbolic acid, well mixed with fifty pounds of land plaster or some other diluent. It is used dry by sprinkling it among plants to be protected, and is said to be very efficient against flea-beetles, Striped Cucumber Beetle, &c.

VII. *Poisoned Bordeaux Mixture.*—The discovery of the great value of Bordeaux mixture as a destroyer of fungous diseases was soon followed by the equally important one that various poisons could be mixed with it and form a joint mixture destructive at the same time of fungous diseases and insect pests. All of the arsenical poisons can be mixed with the lime Bordeaux mixture, and this practice is now a general one, when it is necessary to protect crops against fungous diseases and at the same time to destroy insect enemies. A useful formula for making the Poisoned Bordeaux Mixture for fungi and leaf-eating insects is the following:—

POISONED BORDEAUX MIXTURE.

For Fungi and Leaf-eating Insects.

Copper sulphate (Bluestone)	4 lbs.
Unslaked lime	4 lbs.
Paris green	4 oz.
Water (1 barrel)	40 gallons.

Dissolve the copper sulphate (by suspending it inside a wooden or earthen vessel containing 4 or 5 or more gallons of water.) Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place; half fill the barrel with water; dilute the slaked lime to half a barrel of water, and pour into the diluted copper sulphate solution; make the Paris green into a paste by adding a little warm water and then pour it into the barrel and stir thoroughly. The mixture is then ready for use. (Never mix concentrated milk of lime and copper solution.)

A stock solution of copper sulphate and milk of lime may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of copper sulphate, lime and water should be carefully noted.

To test Bordeaux mixture, let a drop of ferrocyanide of potassium solution fall into the mixture when ready. If the mixture turns reddish brown, add more milk of lime until no change takes place.

When spraying potatoes for potato rot and the Colorado Potato Beetle use six pounds of copper sulphate and eight ounces of Paris green. Arsenites must not be applied in Bordeaux mixture, when this is made with soda instead of lime, or the foliage will be injured.

PART II.

I.—INSECTS INJURIOUS TO GRAIN AND FODDER CROPS.

HESSIAN FLY

(*Cecidomyia destructor*, Say), Figs. 1, 2, 3.

Attack.—In autumn two, three or more small whitish maggots may be found imbedded in the crown of winter wheat or in summer just above the first or second joint of the stems of wheat, barley and rye, where they lie beneath the sheath of the leaf but outside the stem, from which they suck the sap, causing the stem to become weak and fall over. When full grown these maggots harden and turn dark-brown and then resemble small flax seeds. From these in May and June, and again in August and at the beginning of September, emerge small blackish midges with smoky wings, which measure about a quarter of an inch across the expanded wings. The females lay small bright red eggs upon the inside crease of the leaves of the growing plants. The eggs are deposited singly or in clusters upon the upper side of the leaf. The young maggots as soon as they hatch, work their way down to the bases of the leaves where they remain until the perfect flies emerge.

The Hessian Fly has been the cause of enormous losses at different times in many parts of Canada, both to spring and to fall wheat in western Ontario and the eastern provinces, and to spring wheat in Manitoba in 1902. At the present time there is hardly any injury recorded; but this dire enemy of the wheat grower may appear again in any season.

Remedies.—The habits of the Hessian Fly and the best remedies to adopt are pretty generally known by wheat growers and with a little more co-operation a great deal might be done to prevent the increase of this most destructive enemy of our staple food crop. The best remedies are:—

(1.) *Late Sowing.*—The most important preventive remedy is the postponement of the seeding of fall wheat until the end of September, which delays the appearance of the young plants until after the flies of the second brood are dead. At the same time special care should be taken to prepare the land as well as possible for the crop, and in periods of excessive abundance strips of wheat may be sown in August to be ploughed down again with all their contained larvæ by the middle of September.

(2.) *Burning Refuse.*—Many of the flax seeds of the summer brood are carried with the straw and at threshing time fall with the rubbish beneath the machine or are left in the straw. All dust and screenings, therefore, should be carefully destroyed, and all straw and small seeds should either be used up during the winter or burnt before spring.

(3.) *Treatment of Stubbles.*—Most of the puparia of the summer brood are placed so low on the stems that they are left in the stubble when the wheat is cut. In Ontario and the eastern provinces a large proportion of these give forth their flies in August and September; but some, and in Manitoba and the west probably most, pass the winter in the stubble. An effective way of destroying these is to plough the stubbles down deeply as soon after the crop is cut as convenient, so as to place the insects so deep beneath the surface that the delicate flies, when they emerge, cannot reach the surface. As most of the puparia winter in the stubble, the burning over of wheat fields, which for the purpose have been cut rather high, will probably prove the most convenient remedy for this insect in Manitoba, where there is only one brood.

(4.) *Fertilizers.*—When a crop of fall wheat is only lightly infested, it is sometimes possible to stimulate the growth of the plants in spring by making a light application (so as not to cost too much) of some quick acting special fertilizer such as nitrate of soda.

The Joint Worms

(*Isosoma* sp.), Fig. 4.

Attack.—Very small, slender, footless grubs, one-eighth of an inch in length, of a pale-yellow colour, with dark brownish jaws. As many as five to twelve of these may be found occupying cells in a more or less apparent swelling or gall on the straw or in the leaf sheaths of wheat, rye and barley, generally a little above the first or second joint from the root. Most of the larvæ winter inside the galls, but a few transform and appear as flies in late autumn. The perfect insect is a tiny black four-winged fly, only about one-tenth of an inch in length, with clear transparent wings and pale legs.

There are probably more species than one belonging to the genus *Isosoma* which attack the small grains in Canada. *I. tritici*, Fitch, and *I. hordei*, Harr., have been reared. These injuries appear to be of rare occurrence but have sometimes been serious in certain localities. All recorded occurrences have been of short duration.

Remedies.—There is apparently only one brood of the Joint Worms in Canada; and, as they pass the winter in the straw, for the most part so near to the ground that a large proportion of the larvæ are in the stubble left on the fields, they can be largely reduced in numbers by burning over the stubble or by ploughing it down deeply. The broken off hardened pieces of straw which become separated in threshing and cleaning should be carefully gathered and burnt. Sometimes no apparent galls are formed, merely slight swellings with a hard, thickened condition of the straw representing the galls. These portions break off in threshing and many are carried through with the grain. Straw from an infested crop should be got out of the way, either by feeding or burning before the ensuing spring.

Prof. F. M. Webster, of Washington, D. C., who has made a special study of these insects, and who is not only an expert entomologist but also a practical farmer, recommends a regular rotation of crops and the mowing down of all grasses along the borders of fields and waste places in June, as well as keeping up the fertility of the soil, so as to produce a healthy vigorous growth, which will discourage egg laying by the female flies.

The Greater Wheat-stem Maggot

(*Meromyza americana*, Fitch), Fig. 5.

Attack.—A short time before wheat, barley and some grasses should be ripe, the ear and top portion of the stem turn white, causing an injury which has been called 'Silver-top' and 'Dead-heads.' Upon examination, the stem will be found to be severed and consumed just above the top joint by a slender transparent green maggot, one quarter of an inch in length, pointed at one end, and having black horny mouth parts. When full-fed, this maggot works up to the upper portion of the sheath and changes to a slightly flattened clear glassy-green puparium from which the fly emerges about the end of July or during August. The perfect insects are active little greenish-yellow flies, one-fifth of an inch in length with shining green eyes and three dark stripes extending down the back. The hind thighs are much thickened, and, when the fly is at rest, the fore part of the body is raised.

There is some doubt as to the number of broods which ordinarily occur in a year, but close observation in 1889 showed three distinct broods. Perfect flies of the first brood which had wintered over as larvæ in winter wheat and grasses, were found in considerable numbers in the beginning of June. These laid eggs in the root shoots

and in the stems of wheat, barley and rye, as well as in some grasses. The flies from these, the second brood, emerged at the end of July and through August, and laid their eggs upon volunteer fall wheat and barley, the flies coming to maturity in September and then laying their eggs on fall wheat and wild grasses. Larvæ from this brood were also found half-grown in large numbers in the roots of volunteer barley in the middle of September. The empty egg shells from which the larvæ had hatched, were found adhering to the first leaf of infested plants and the central leaf was dead, making it an easy matter to detect the injured plants. Flies taken at the end of September may possibly have been belated specimens of the second brood of larvæ. It is thought by some that there are only two regular broods of this insect in Canada, and this may possibly be the case; but the chief injury by this insect is done to fall wheat fields in autumn and to the root shoots of spring sown grain by the larvæ which come from eggs laid by the flies which emerge from the over-wintering brood.

The Greater Wheat-stem Maggot is an insect which has a wide range of distribution and is abundant at any rate from the Atlantic coast to the Rocky Mountains, and possibly occurs right through to the coast. The natural food plant is most probably wild grasses.

Remedies.—(1) The collection (hand picking) of the conspicuous Silver-tops as soon as they appear in the field. (2.) Treatment of volunteer crops. It has been found that the flies which emerge in summer lay very freely upon any young plants which may spring up in fall wheat and barley fields directly after these crops are reaped. Harrowing fields immediately after harvest would encourage the growth of a volunteer crop upon which eggs would be laid; and this could be ploughed down before September. As the flies begin to emerge late in July, strips of wheat or barley sown near infested fields would act as an alluring bait to attract females to lay their eggs. The succulent young plants would probably be more attractive than wild grasses at that time and would also be in advance of any volunteer crops. These strips should be ploughed under in August to destroy the half-grown larvæ. This probably would prove the most effective means of checking this insect. (3) Late sowing. It has been found that fall wheat sown after the 25th September was much less attacked by this insect than that which was sown at the ordinary time.

The Lesser Wheat-stem Maggot
(*Oscinis carbonaria,* Loew).

Attack.—Small yellowish-white legless maggots, ⅛ of an inch in length, found in autumn destroying the bases of the shoots of grasses and fall wheat. Also occurring in spring wheat and grasses in June, attacking the young root shoots, close to the ground. The two small black hook-like jaws are distinctly visible and the last division of the body bears two little knob-like processes. The puparium is found where the larvæ have fed, and is pale chestnut brown. The two knobs at the end of the body are still conspicuous. The fly is shining black and very small, large specimens being only 1-15 of an inch in length. The underside is pale green, the legs are partly yellow and the fly is extremely active.

This is the same insect as has been treated of in my former reports under the name of the American Frit Fly (*Oscinis variabilis,* Loew). Prof. F. M. Webster having kindly examined my specimens collected in 1890, when a serious outbreak occurred in central Canada, informs me that they are undoubtedly *Oscinis carbonaria,* for which he proposes the appropriate name of the Lesser Wheat-stem Maggot. The differences between this and *O. variabilis* (which is now called *O. soror,* Macq.,) are slight.

The life histories of the two Wheat-stem Maggots are similar, and the same remedies are applicable for both.

Remedies.—In a general way, the remedies which are recommended for the Hessian Fly, will answer for both of the Wheat-stem Maggots. Particular attention should be given to volunteer crops, and a regular short rotation of crops should be adopted in districts where these flies appear. As both the Wheat-stem Maggots breed largely in wild grasses, the burning over of grass lands, except timothy, which fortunately is not attacked, and all waste places, will offer much protection. This should be done in winter or early spring. Prof. Webster also draws special attention to the value of late seeding of fall wheat.

The Wheat Midge

(*Diplosis tritici*, Kirby):

Attack.—When wheat is in blossom in the month of June, minute yellow midges with black eyes may be found, particularly towards evening, flying over the fields and laying eggs in the florets of the ears of wheat. These eggs in about a week hatch into small reddish-orange maggots, which sometimes to the number of ten or twelve lie inside the chaff and suck the juices from the swelling kernel. When mature, they leave the ears of wheat and penetrate about an inch beneath the surface of the ground, where they spin tiny cocoons, inside which they remain normally until the following spring, when the perfect midges emerge. Under special circumstances, however, some of the flies appear in late summer and lay their eggs upon volunteer wheat or the young fall wheat.

It is many years since the Wheat Midge, which is generally known by farmers and millers as 'the weevil,' has been the cause of much loss in the wheat crop of the Dominion. Fifteen years ago the losses were enormous; but, just when it seemed at its worst, it suddenly disappeared entirely and since that time has not been the cause of widespread injury. There have been occasional outbreaks, as in the Niagara district in 1898 and last year in the fertile Chilliwack district of the Fraser River valley, B.C., where it was estimated that in some fields fully half the crop was destroyed.

Remedies.—The remedies for the Wheat Midge depend largely upon the way it passes the winter. The methods which have given the best results are as follows:—

(1) Deep ploughing directly the crop is carried, so as to bury the larvæ so deep that the flies cannot work their way out through the soil.

(2) The burning of all chaff, dust or rubbish known as 'screenings' or 'tailings' from beneath the threshing machines, as these contain many of the larvæ which are carried with the crop. If fed to chickens or domestic animals, this should be done in a place where none of the puparia can escape destruction.

(3) Clean farming, including the cutting of all grasses along the edges of fields and the ploughing down of all volunteer crops found in wheat fields before winter sets in, so as to destroy an autumn brood where one exists.

(4) The cultivation of such varieties of wheat as experience has shown are least affected by this insect.

The Western Wheat-stem Sawfly

(*Cephus occidentalis*, Riley & Marlatt), Fig. 6.

Attack.—Slender white grubs found inside stems of wheat which have fallen down just before it ripens. The head is rounded, yellowish; mandibles darkened. Body swollen at the first two joints after the head and tapering slightly to the end of the body, where there is a short blunt tubercle with a dark hard tip. When full-grown these grubs are nearly half an inch in length, and by this time each one will have bored through all or most of the knots in the stems of wheat in which they are, leaving a discoloured tunnel extending from the top joint, down to the root, where, when mature, after partially gnawing through the stem, they spin thin transparent cocoons

in which they pass the winter and change to pupæ the following June. From these emerge, about mid-summer, black shining four-winged sawflies about one-third of an inch in length, banded and spotted with yellow. These flies lay their eggs in the young wheat, just as the ears are appearing from the sheath, and the larvæ hatch very soon, coming to full growth by the end of August, when the attack is usually noticed by farmers from the number of straws which fall down or break off, owing to the larvæ having gnawed away some of the inside substance of the straw so as to cut a ring all round it before spinning their cocoons.

For several years a wheat-stem sawfly has occurred intermittently at various and widely separated localities in Manitoba and the North-west Territories, and has sometimes been the cause of so heavy a loss as one-quarter of the crop, but usually much less than that. It was at first supposed that this insect was the same species as was treated of in 1889 by Professor Comstock (Cornell University, Coll. of Agric. Bull. 11) as the European *Cephus pygmæus*, L. which appeared suddenly at Ithaca, New York, in 1889 and then disappeared entirely and has not since been observed there. Under the name of *C. pygmæus*, I have referred to the Western Wheat-stem Saw-fly in previous publications; but, specimens of our North-western insect have recently through the kindness of Professor A. D. McGillivray been identified as *Cephus occidentalis*. The differences in the markings of the two species are very slight and are also variable. The habits of the two insects are identical. It seemed more probable that the species which gives trouble in our western wheat fields would prove to be a native species which had spread from wild grasses, than that a European species should have been introduced into the West without appearing at intervening points. Larvæ of two different species of *Cephus* have been observed in the stems of wild grasses in Manitoba; and it can hardly be doubted that one of these is the same as has injured wheat from time to time in the same districts.*

Remedies.—As most of the insects pass the winter in the base of the straw, all stubble should be burnt over in autumn or spring, or should be ploughed down deeply before the middle of June, so as to make it impossible for the flies to work their way up to the surface. Stubble fields left for summer-fallowing should be turned down early in June; and, should the insect at any time become more destructive than it has in the past, early summer-fallowing should be practised every other year. Some of the cocoons are spun high enough up in the straw to be cut by the binder; therefore, all straw from an infested field which has not been fed by spring, should be burnt.

The Grain Aphis

(*Nectarophora granaria*, Kirby; &c.), Fig. 7.

Attack.—Green, yellow, reddish, or dark-coloured plant-lice, sometimes occurring in large numbers upon the heads and leaves of wheat, oats, barley and rye, weakening the plants and preventing the kernels from filling as well as they should. These plant-lice generally disappear suddenly just as the grain is beginning to change colour, being as a rule destroyed by their many parasitic and predaceous enemies before much harm is done to the crop.

It is probable that there are two or three species of plant-lice which attack grain as described above. It is known that some broods of several species feed upon one class of plants during part of their lives and upon grasses of various kinds at other periods of their existence. Some of these, as the Apple Aphis, occasionally may be found upon the small grains and grasses. It is convenient to speak of all these kinds occurring upon grain crops under the name of Grain Aphis.

Remedy.—So far, no treatment has been discovered for controlling plant-lice when on grain crops; but fortunately they seldom affect the output to any considerable

* Since the above was written, Mr. Norman Criddle has reared the species in some numbers from steams of *Agropyrum caninum*, a common wild grass in the West.

extent. The Apple Aphis (*Aphis mali,* Fab.) frequently develops into a serious enemy of young fall wheat; and, as this insect passes the winter as an egg upon the twigs of apple trees, the regular spraying of apple orchards with kerosene emulsion (Remedy 2), would not only clear those trees of a serious enemy, but also to a large measure protect the fall wheat of the following season. A similar alternation of generations takes place in the case of the Hop Aphis, which passes the winter in the egg state on plum trees, from which a winged brood of the plant-lice the following summer migrates back again to their summer quarters on the hop. Spraying the plum trees during the winter reduces largely the occurrence of Hop Aphis later in the year.

Wireworms

(Larvæ of Click Beetles, *Elateridæ.*)

Attack.—Slender, cylindrical, yellowish or reddish-brown, tough and shining grubs with flattened heads and dark jaws. These grubs have only three pairs of legs on the three segments following the head and a single short sucker-like foot in the middle of the last segment, beneath. When full grown they are about an inch long and only about 1-12 of an inch wide. With these will be found many specimens in spring of about just half the size of the larger ones. Wireworms occur most frequently in low ground and attack the roots of almost all plants, but particularly young wheat and corn just as it is coming up. They also bore into the tubers of potatoes in autumn. This injury is most frequent on land which has been for several years in sod, and the attack is most severe in the second season after the sod has been ploughed down.

Wireworms are the grubs of a large family of beetles known as Click-beetles, easily recognized by their power of snapping their necks with a click with such force as to spring up into the air if they fall on their backs. These beetles are many of them dark brown in colour, of an elongated oval form, about three times as long as broad, and tapering to the end of the body. The eggs are laid in summer about the roots of grasses and weeds, and the larvæ of most species take two years to come to full growth. They change to pupæ inside cells in the ground in July, and to perfect beetles about three weeks later in August. Most of these beetles, like the May Beetles, remain in their pupal cells until the following spring before emerging.

Remedies.—Agricultural methods are the only ones that have been of much avail. The wireworms which are injurious to the farmer are particularly those which feed on the roots of grasses. When sod is ploughed down, the larvæ during the first year feed for the most part on the decaying grass and its roots. Those in their second year of growth change to beetles in the first year, and do little harm, as they have had plenty of food in the decaying sod without attacking the crop; but the young larvæ which were only half grown when the sod was broken, attack the crop of the following year, because there is nothing else on the land for them to eat. It has been found that barley and rye are less attacked than any others of the small grains, and also that clover is little injured. Those early maturing grains are, therefore, better suited as a crop for the second season after sod, because the land can be ploughed immediately after they are harvested, and thus the pupæ and the freshly formed and still soft beetles are disturbed in their pupal cells, and many of them destroyed. Clover may be sowed in spring with either of these crops, and either ploughed down with the stubble in September or left on the land until the following autumn, when the land should be ploughed as soon as there is a good growth after the first cutting. A short rotation in which land is not left in grass for more than two years, will to a large measure prevent the ravages of wireworms. Prof. S. A. Forbes recommends ploughing down sod in autumn and sowing to fall wheat or rye, with clover on these in the spring, the clover to be left for two years and then followed by corn or roots. Some farmers have obtained good results in clearing land of wireworms by ploughing twice in the same autumn, the first time in August, the land to be well harrowed a week later, and then cross-ploughed in September.

Extensive experiments made by Prof. Forbes in Illinois and Prof. Slingerland in New York, showed the uselessness of many recommended remedies, such as coating seed grain of all kinds with poison, the surface application of salt and other chemicals, and even of a clean fallow to stare the wireworms out.

White Grubs

(*Lachnosterna fusca,* Fröh.; &c.), Fig. 10.

Attack.—White Grubs are the larvæ of the May Beetles or June Bugs, so-called from their great abundance in May and June, when they may be found in large numbers flying around trees and bushes, showing particular preference for certain kinds, as willows, oaks, ashes, plums, maples and lilacs. The eggs are deposited in the ground, one to three inches below the surface, and hatch in from ten to eighteen days. The larvæ feed on roots during the remainder of the season and burrow very deeply into the ground as winter approaches, returning again the following spring and doing a great deal of harm by eating the roots of grasses and many other kinds of plants, particularly corn and potatoes, their injuries being most noticeable in the second year after sod has been ploughed down. It is claimed by Dr. S. A. Forbes that a second winter and summer is passed as a larva and that the grubs do not change to pupæ till June and July of the third season, the perfect beetles issuing from the pupæ two or three weeks afterwards, but passing the third winter in the pupal cells and emerging the following June. Thus three full years are consumed from the time the eggs are laid until the perfect beetles appear.

Remedies.—Unfortunately, there are no measures which can be depended upon for the destruction of White Grubs in most crops; but as the eggs are laid mainly in grass lands, land which has been in sod for several years should not be planted to corn or potatoes, the second year after breaking. The first year the grass which is ploughed down to a large measure, feeds any grubs which may be in the ground; and, as pigs are particularly fond of these grubs, a crop such as rape or turnips may be sown with advantage and the field turned into a hog pasture, when the pigs will not only feed on the crop, but hunt out many of the grubs in the soil. It is claimed that these animals will, in the course of a few weeks, completely clear a badly infested turf. On account of the depth to which the grubs burrow before winter, these crops should be fed off before the first frosts. Clover, it has been particularly noticed, is seldom attacked by White Grubs; therefore, this crop becomes of special value for growing on land which it is intended to use for corn or potatoes the following year. When as is sometimes the case, White Grubs appear in large numbers in meadows, this fact is manifested by the dying of the grass in large patches. If, on examination, the grubs are noticed, pigs should be at once turned in, and before autumn the patches renovated with fresh seed.

Leaving land under grass for several years gives opportunities for White Grubs to increase; hence a short rotation in which clover follows grass or is grown at short intervals, will prevent the increase of these insects. In this special rotation the small grains should follow clover before corn or potatoes. The collection of the perfect beetles by beating trees at night time has sometimes been practised with advantage, and a flock of poultry following a plough in infested fields it is claimed has done good work.

When May Beetles attack fruit trees or are found abundantly on other trees, spraying the foliage with arsenical poisons will destroy large numbers, or, as they are much attracted by lights, the beetles may be killed in lantern traps by placing lanterns in large pans of water with coal oil on the surface.

When White Grubs are found destroying lawns some good may be done by spraying the grass freely with kerosene emulsion (Remedy 2) and washing it in with water.

Cutworms in Grain, Fig. 8.

Different kinds of cutworms attack grain crops during the spring and sometimes eat them bare. They seem to be most numerous where weeds have been allowed possession of the land during the previous autumn. The species which has been most frequently detected feeding upon the small grains is the Red-backed Cutworm (*Paragrotis ochrogaster,* Gn.). Two other species, however, when they occur, are much more difficult to reach, because they feed chiefly upon roots and work almost entirely beneath the surface. These are the Glassy Cutworm (*Hadena devastatrix,* Brace), and the Yellow-headed Cutworm (*Hadena arctica,* Bdv.). These are of a dirty whitish colour, very similar in general appearance, but the former has a reddish-brown head, and the body is tinged with bluish green, while the Yellow-headed Cutworm has a smoky-gray body, and the head and neck-shield are tawny-yellow. The crops most attacked by these cutworms are oats, wheat, corn, and grass in meadows.

Remedies.—When grain is found to be attacked by cutworms the fields should at once be examined to discover if possible what species is at work. If the cutworms are of a surface-feeding kind, like the Red-backed Cutworm, they may frequently be controlled with comparative ease by scattering poisoned bran lightly through the grain, near the spots where the caterpillars are most numerous, or ahead of them, when they are so numerous as to have assumed the marching habit. (See page 30.) If land is systematically kept clear of weeds in autumn, there will seldom be trouble from cutworms in the crop of the following year. Prairie or sod land which is to be broken for seeding the next year should be fed off as late as possible or mowed before breaking. In this way the female moths will not be attracted to the tall vegetation on such lands when laying their eggs.

The Corn Worm

(*Heliothis armiger,* Hbn.), Fig. 35.

From time to time complaints are received from various parts of the country of more or less injury to sweet corn in autumn by the caterpillar of a noctuid moth which is known by various popular names. It is what Professor Lugger called the Sweet-Corn Moth, or Tassel Worm, in Minnesota, and is also the same as the notorious southern 'Boll Worm' of the cotton, to which crop it frequently does great damage and for which it has been found very difficult to find a practical remedy. The name of widest use is the Corn Worm, although its injuries in Canada are not confined to Indian corn, for the caterpillars have also been found boring into the fruit of tomatoes and attacking many other plants. There is but one brood in the year in Canada, the caterpillars occuring in autumn and the moths from these emerging the following summer. The worst injury by this insect in Canadian crops is to the cobs of sweet corn, because the work of the caterpillars renders the ears unsightly and discoloured so as to be unfit for the table.

Remedies.—Unfortunately this is a very difficult insect to keep in check. When it attacks corn, as described above, it is seldom noticed until a considerable amount of harm has been done. Where the caterpillars are troublesome regularly every year, growers, it is claimed, get into the way of recognizing at a glance, ears which are infested, by the discoloration of the silk earlier than is natural in perfect ears. As soon as an infested ear is discovered, the leaves of the husk are pulled back and the caterpillars destroyed by hand. Where, as in Canada, it is only at long intervals that harm is done in any one place, corn growers are taken by surprise, and the injury is done before it is noticed. It is claimed that many of the moths may be taken in lantern traps consisting of a lamp standing in an open pan containing water with a little coal oil on top of it. Any one, therefore, who knew the appearance of the insect, upon recognizing the moths in years of great abundance flying around lights

at night, might place lantern traps as described above in his crop, and thus prevent future loss; but this insect, like many others which appear in an intermittent manner, will always be a source of trouble. On fields where a crop of corn is known to have been attacked by the Corn Worm, the old stems should be removed from the field as soon as the crop is gathered, and the land ploughed deeply in autumn so as to break up the cocoons and expose the pupæ to the weather and their various enemies among the small birds and mammals.

Grasshoppers or Locusts,

Figs. 11, 12, 13, 14.

Attack.—Grasshoppers, or locusts, sometimes multiply enormously, especially during a dry season following another of the same character. They then become very destructive to grain and other crops. Most of the injurious species pass the winter in the egg state. The females deposit their eggs in the ground in 'pods,' or masses, of about thirty or more cemented together by a mucous fluid. The young grasshoppers are wingless and can only travel by hopping, but after several moults they acquire wings and are able to move freely from place to place, some species, especially the voracious so-called Rocky Mountain Locust (*Melanoplus spretus,* Uhler), being able to fly long distances. The species is found only in the West. It is about one and a quarter inches long, from the head to the tips of the closed wings. Another migratory and destructive species, rather smaller in size, is the Lesser Migratory Locust (*M. atlanis,* Riley). This latter is much more generally distributed throughout the continent.

Several non-migratory locusts have in some years appeared in destructive numbers, as the Red-legged Locust (*M. femur-rubrum,* DeG.) and the Two-Striped Locust (*M. bivittatus,* Say), in all parts of Canada. In the West, Packard's Locust (*M. packardii,* Scudd), and the Pellucid Locust (*Camnula pelluciaa,* Scudd), frequently add their injuries to those of other species.

Extensive losses from locusts have taken place in various parts of Canada in certain seasons; but by far the most important ravages have been wrought in Manitoba and British Columbia. Various species take part in this devastation, but the most destructive species in British Columbia has proved to be *Camnula pellucida,* Scudd., although much harm was done in the Nicola valley by a species closely resembling the Rocky Mountain Locust, but a rather smaller species called *Melanoplus affinis,* Coq., which has the same habits. In Manitoba the Rocky Mountain Locust and the Lesser Migratory Locust have done by far the largest proportion of injury to crops.

The eggs of the Rocky Mountain Locust are laid by preference in light soil with a firm surface, such as is presented in a field under a grain crop. So much is this the case that, when such conditions are available, hardly any eggs will be laid elsewhere. In Manitoba the young grasshoppers hatch in May, become full grown and have wings about the 1st July, when they begin migrating in swarms to fresh feeding and breeding grounds. Egg laying takes place mostly in August, and the numbers drop off rapidly from the beginning of September, although a few may be found lingering on until frost comes.

Remedies.—For the migratory species the remedies are: (1.) The ploughing down of the eggs in autumn or before the young hatch in spring. This is rendered easy by the fact mentioned above that the eggs are laid almost entirely in land which is or has recently been under crop and hardly ever on the bare prairie. (2.) The destruction of the young before the wings are developed, by ploughing down, poisoning, or by burning in windrows of straw placed as traps for them, and to which they will resort in large numbers at night. (3) Catching in implements known as hopper dozers, consisting of a light frame covered with canvas or sheet iron, in the bottom of which some water with a little coal on the top is placed. (4.) Poisoning. This

has been very satisfactory either with the poisoned bran mash or with the recently devised Criddle mixture. In Manitoba, where for some years grasshoppers were very destructive, after a thorough trial of hopperdozers, these implements have been entirely superceded by the use of the Criddle mixture, which was widely used and gave general satisfaction. The latest improved formula for making the Criddle mixture is as follows:—For convenience it is made in quantities of half a barrel at a time. Take fresh horse droppings 100 parts, Paris green 1 part (= 1 pound) and salt 2 pounds, dissolved in half a pail of water, and mix thoroughly. In this connection Mr. Criddle, the originator of this mixture, says: 'We usually measure with a three-gallon patent pail, because it is more convenient to farmers than to weigh the materials. Five pails, we calculate, approximately equal 100 parts of horse droppings, and each part equals in bulk one pound of Paris green. A great drawback in using weights is that horse droppings are not always of the same weight.' This mixture is made in a half barrel and drawn on a cart to the edge of an infested field, or one likely to be infested. The mixture is then scattered broadcast along the edge of the crop by means of a trowel or wooden paddle. Locusts are attracted to it from long distances and are killed in large numbers by eating the poison. If this mixture is distributed as above, and scattered loosely through the plants at the edge of a field of standing grain, there is little danger of stock or poultry being poisoned. Should any of the mixture be left over, it should be scattered loosely over a piece of land where its fertilizing effects will be secured and where there will be no danger of poisoning animals. This is in every way the cheapest and most effective remedy for grasshoppers which I have ever tried. It has been found by Mr. Criddle that the most effective way of using this remedy is to spread a little at a time every other day, which gives far better results than scattering a lot at once, less frequently.

Fungous Disease.—Much has been written about the parasitic fungous disease which has been experimented with in different parts of the world, with a view of destroying locusts in a wholesale manner. The idea of treating outbreaks of injurious insects by means of introducing parasitic insects or fungi, is an exceedingly attractive one, and, to those who have never studied these matters, is apparently a very easy solution of a difficult problem. It seems well, however, to mention that my own experiments in this direction have been of little avail; and I regret to say that, on the whole, this fungus has not proved of much service anywhere as a reliable remedy in outbreaks of injurious locusts. For a short period, and in restricted localities with all weather conditions favourable, good results have occasionally been obtained; but the difficulty of preserving the spores alive and using them when required, has been so great that all entomologists who have experimented with the fungus, have after a short time relinquished the effort in favour of other methods not so dependent for their most effective use on climatic conditions.

Locusts Eating Binder Twine.—A source of great annoyance to farmers in Manitoba and the West, is that locusts of all kinds and field crickets sometimes eat the twine with which grain is bound in the field. This injury causes a good deal of loss and extra labour. Mr. Criddle has found that, if the balls of binder twine are soaked before use for a short time in a solution of bluestone, two pounds in seven gallons of water, this will prevent the insects from gnawing it. The balls may be soaked at any spare time, so that they are dried thoroughly before use.

The Pea Moth

(*Semasia nigricana,* Steph.), Fig. 15.

Attack.—Small, whitish, slightly hairy caterpillars, when full-grown, about half an inch in length, which live inside the green pods, attacking the peas by gnawing ragged-edge cavities into them and filling the pod around the cavities with a mass of excrement.

The Pea Moth, shown at fig. 15 (3, 4) in the perfect form, is a small slaty gray moth, three-eighths of an inch in length. The moths, however, are seldom seen, the insect being generally observed by pea growers when in the caterpillar state, in which condition it is usually called 'the worm.' It frequently does a large amount of injury to the pea crop of Canada, chiefly, however, in districts lying east of the area infested by the Pea Weevil and increasing in severity as the Atlantic sea-board is reached.

'Wormy pease' are well known to the housekeeper in all parts of Canada east of the great lakes, but it is seldom that they are sufficiently abundant in gardens to cause much complaint, except in the maritime provinces, where the insect is much more destructive than elsewhere. It is thought that the Pea Moth is identical with the European species and that it has been introduced into America at a comparatively recent date. Possibly this may not be the case. Its injuries are most severe on late pease, and it is occasionally the cause of extensive loss in crops of high class pease grown for seed. It is probable that the eggs are laid early in July and are deposited on the outside of the pods throughout the month, as very small larvæ are found in the pods almost up to the time the seeds are ripe. Larvæ begin to emerge from the pods at the end of July and enter the ground, when they spin small oval cocoons near the surface. Here they pass the winter, and the moths do not emerge until late in June the following season. Exact data as to the life-history of this insect, with the dates covering the different stages, are still lacking.

Remedies.—It has been noticed that the earliest maturing and the latest varieties of pease are freest from attack, which would point to the importance of:—

(1.) The planting of pease as early as possible and, where the Pea Moth is destructive every year, sowing the earliest ripening varieties, many of which can be grown ready for the table by the first week in July. These will be quite free from the attacks of the caterpillars.

(2.) As the cocoons are spun in the ground beneath the plants they have infested it is advisable to use every year fresh land, as far as possible removed from fields which have been used before for the cultivation of seed pease. In gardens where the land is regularly dug every year, this should be well done, so as to bury the cocoons so deeply that the moths cannot emerge, and all pea vines should be burnt with the small imperfect pods, directly the main crop has been picked.

(3.) From some experiments it has been indicated that benefit may be derived by spraying the pea vines directly the young pods are formed and twice afterwards at intervals of ten days, with a liquid wash of Paris green, 4 ounces, and soap one pound in 25 gallons of water.

The Pea Weevil or 'Pea Bug'

(*Bruchus pisorum,* Linn.), Fig. 16.

Attack.—A small, brownish-gray, very active beetle, one-fifth of an inch long, with two conspicuous black spots on the end of the body, which emerges from seed pease in autumn or in spring, leaving a small round hole.

The life history and habits of the Pea Weevil are well known. The egg is laid on the outside of the young pod, and the grub, on hatching, eats its way in and penetrates the nearest pea. Here it remains until full-grown, consuming the interior of the pea and passing through all its stages, from a white fleshy grub to the pupa, and then to the perfect beetle. As a rule, the beetles do not, under ordinary circumstances, leave the pease until these are sown the following spring. Some of the beetles, however, in certain seasons, escape from the pease, occasionally as early as harvest time, or during autumn, and pass the winter hidden away under rubbish, or about barns and other buildings. On reviving in spring they fly to the fields of growing pease, sometimes long distances away and for a time feed on the foliage of the pea plants. As soon as the young pods are formed, the females lay their eggs on them. The beetles all become fully developed at the same time, which is about the middle of August, and all, whether they winter outside the pease or inside the grain, die about the same time the following season, viz.: during the month of June.

Loss by sowing Weevilled Pease.—That seed pease which have been bored by weevils are very seriously injured, I have proved by actual experiments. Weevilled small pease gave only from 13 to 20 per cent of plants which bore pods, and these were all weaker than plants from perfect seed. Large pease gave a better percentage of from 16 to 28 per cent. Therefore, weevilled pease should not be used for seed if any other stock is obtainable. If, however, this is impossible, much more seed should be sown to the acre.

REMEDIES.

Fumigation.—Fumigation with bisulphide of carbon is a sure remedy. For the treatment of small quantities of seed, particularly by farmers, an ordinary coal oil barrel is very convenient. This will hold about 5 bushels, or 300 pounds of seed, and may be treated with 3 ounces of bisulphide of carbon, which may be poured right on to the pease. Care must be taken to close up the top tightly. This is best done with a cap made specially for the purpose, but may also be done with fine sacks dampened and laid smoothly on the top, over which boards are laid, with a considerable weight on them to hold the covering down closely. The bisulphide of carbon should be of the best quality, which will vaporize without any residue, and the exposure should be for 48 hours. Pease should be fumigated as soon as possible after harvest, but they may be treated at any time when the temperature is above freezing. As the vapour of bisulphide of carbon is very inflammable, this work should be done at a distance from other buildings and no light of any kind must be brought near. No smoking must be allowed near the buildings where the bisulphide of carbon is being used. Where large quantities of pease are to be treated at once, in specially prepared houses, one pound of bisulphide of carbon to every 100 bushels of seed, is the amount regularly used by large seed houses, as in these tightly constructed 'bug houses' there is less waste of the vapour during the necessary exposure of 48 hours.

Holding over seed.—Where only a few seed pease are used, a most reliable remedy is the holding over of seed until the second year. Pease should always be bagged up and the sacks tied at once after threshing. The weevils are not able to eat their way through the bags, even when these are made of paper. All the weevils which emerge, either in autumn or the following summer, will perish inside the bags, and the seed can be sown the following year without danger; the sound seed will not be injured by being held over. Seeds showing the hole from which weevils have emerged should be sorted out before sowing.

Treating with coal oil.—A remedy which has been used by many farmers with satisfaction, is to drench the seed about two weeks before sowing with coal oil, using about half a gallon to a barrel, or five bushels of seed. Immediately after putting on the oil, the pease should be shovelled over and over, so that all will be oiled, and the shovelling must be repeated every day for four or five days. This, if properly done, will kill all the weevils in the pease without injuring the seed.

Scalding seed.—Of the same nature, when pease are found at the time of sowing to contain weevils, is scalding the seed. This may be done by pouring them into scalding water and then either pouring the water straight off them again, or cooling off immediately with cold water.

RECOMMENDATIONS.

The control of the pea weevil, I believe, is possible but this must be done, I think, not by legislation or by giving up the cultivation of such an important crop as peas, which we cannot well do without, but by persuading everyone who sows pease to abstain from sowing any seed which contains living weevils; when purchasing seed, to refuse

determinedly to buy any without an assurance that they have been treated, and further, even with this, to examine for themselves to see that any contained weevils are really dead. I would also point out that, from the experiment already cited of growing peas from weevilled seed, such seed is only worth about one quarter as much as sound seed. To secure a supply of seed pease free from weevil injury, it will be necessary for growers and farmers to handle their crop a little differently than has been the usual practice. The injury is of an exceptional nature, and exceptional measures must be taken to avoid loss.

There are, however, special features about this attack which renders its control a simpler matter than is usually the case with injuries of an equal magnitude. The Pea Weevil is not a native insect and has no native food plant, in which it could propagate, were there no cultivated peas. Indeed, it is so restricted in its food habits that no other food plant is known than the different cultivated varieties of true peas, belonging to the botanical genus *Pisum*. These peas will not live over the winter in our climate if left in the open field, at any rate, in any part of the country where the Pea Weevil is known to breed, consequently, every seed pea sown for crop must, at some time before it was sown, have been under the control of some one by whom it could have been treated before sowing, to destroy the contained weevil, if it had one. The remedy is effective, easy and cheap, is well known and can be applied by anyone. If all growers would combine and do this, the larger number of the weevils would be destroyed in a single year. This, however, would not be sufficient, because a certain number of the insects sometimes leave the pease during the autumn when the seed ripens, and this sometimes before the pease are carried from the fields. This fact is the one great difficulty in arriving at a perfect remedy, but I do not believe that it is insurmountable.

1. I suggest that all pease for seed should be treated before they are sown to kill the weevil and that seeding should be done as early as possible, so as to get the crop ripe enough to harvest earlier than is the usual custom.

2. That pea growers should harvest their pease as much on the green side as is safe, rather than, as is usually done now, when they are dead ripe, and thresh and treat them themselves or sell at once to grain buyers. This has many advantages. Not only is the straw of very much higher quality for feed, but the seed is heavier and better for every purpose, for export, for feed and also for seed, because it is of higher germinating power, and further, because the weevil at that time is much less advanced in growth and consequently has destroyed a much smaller proportion of the bulk of the seed. The average dates for pea harvesting are from July 20 to August 20.

Experiment has shown that the weevil at all stages may be killed inside the pea by fumigating the seed with bisulphide of carbon, consequently, if growers will harvest and thresh earlier than usual for a few years and either themselves treat their seed immediately or sell to the grain buyers, who for their own sakes will do so, much good must surely result. When for any reason pease cannot be treated at once or disposed of, they should be bagged up and the sacks tied immediately so as to prevent the escape of any weevils which might emerge in the autumn. When the grain is required for feeding the pease should be ground as soon as they are dry enough, and to prevent the meal from becoming musty the new pease should be mixed with some old pease when grinding.

Difficulties to be met.—Sometimes pease ripen so unevenly that by reaping early it is feared that the sample will be very uneven when threshed; but, should this be the case, it simply means that the small and shrivelled pease are blown out of the seed pease when they are cleaned and are not lost but can be used for feed. The greatest difficulty of all is with regard to the pease which are shelled out in the field at the time of harvesting. This, however, will be to a large measure obviated by reaping early, as the seed will not shell out nearly so much as when left till the regular time. The cleaning up of pea fields moreover by turning in hogs is a generally recognized practice, and the work is done thoroughly. Where hogs are not available, poultry will do the

same work, and, where neither of these can be used, the land should be ploughed so deeply that the weevils cannot work their way out when they leave the pease. I am aware that it is not the custom to plough up pea fields for fall wheat, but simply to cultivate or disc them, because the land is left in such excellent condition; but it must be remembered that the loss from the Pea Weevil is now excessive, and, if this small change in method can be shown to be of great advantage, it surely is worth a trial.

Another difficulty suggested is that it would be hard to get all pease threshed before the autumn emerging weevils escaped, on account of the small number of threshing machines which would be available. In reply to this, experience has shown that demand will always produce supply; and I feel sure that the implement makers will not lose such an opportunity of pushing their business. The much higher price obtainable for the early threshed pease, to say nothing of the enormous value of future crops due to controlling the weevil, will very soon repay to the farmer the initial expense. Where, however, there is no possibility of getting a threshing machine, I would draw the attention of growers to the old-fashioned method of treading out the pease with horses. That this is advantageous is indicated by the fact that some of the seed merchants pay a higher price for pease threshed with horses.

The Bean Weevil

(*Bruchus obtectus,* Say), Fig. 17.

Attack.—Small beetles closely resembling in shape and movement the Pea Weevil, but only half its size, namely, 1-10 of an inch long, oval in form, with the head bent down and more or less concealed as seen from above, and prolonged into a short squarely cut snout. Antennæ distinctly jointed and enlarging towards the tip; the first 4 and the last joints reddish. The wing covers marked with ten impressed and dotted longitudinal lines. The whole body covered with short silky hairs. The lines on the wing covers are broken up into pale yellowish dashes and dark brown spots. The tip of the abdomen extends beyond the wing covers and is of the same reddish tinge as the tips of the antennæ and the legs, but is covered more or less with short silky hairs and bears a central white line, but there is no appearance of the two black spots which are so conspicuous in the Pea Weevil.

The life history of the Bean Weevil differs in some important points from that of the Pea Weevil. The eggs of both are laid upon the pods while these are young and tender. On hatching, the young grub of the Bean Weevil eats its way inside and penetrates one of the forming beans, several grubs entering a single bean, each one forming for itself a distinct cell. They become full-grown and change to pupæ in the autumn and a little later to the perfect beetles. The date of emergence from the seed depends very much, as in the case of the Pea Weevil, on the temperature in the autumn months; it may be in the late autumn or not until the spring; when the seed beans are stored in a warm building, the beetles may emerge at any time through the winter. One of the important differences between the life histories of the Pea and Bean Weevils is that, whereas in the case of the former the young grubs can only enter the soft green seeds, those of the Bean Weevil can propagate for three or four generations in the dry stored seeds. This fact renders the well known domestic remedy for the Pea Weevil of holding over the seed for two years quite ineffective in the case of the Bean Weevil; that is, if a bag of pease infested with Pea Weevil were put away for two years, the Pea Weevils would emerge the first spring and die in the bags. But, in the case of a bag of beans infested by the Bean Weevil kept in the same way, the beetles on emerging would at once set to work to lay eggs upon the beans. The young grubs when hatched would penetrate the dry seeds and go through all their stages, and this breeding might be repeated as long as the supply of beans lasted. Curiously enough, the Pea Weevil does not bore holes through the paper or cotton bags in which infested seed has been stored, but in the case of the Bean Weevil such bags are readily perforated and the beetles escape,—frequently, when this happens in houses, as is sometimes the case, to the great consternation of the inhabitants.

The Bean Weevil seems to be a cosmopolitan species, the original home of which was in Asia. It was probably introduced into America through commerce and has been the cause of considerable damage in various States of the American Union. It has been mentioned in the reports of several United States entomologists, full articles being given by Professors Riley, Popenoe and Lintner. There has been a great deal of discussion as to the proper name of the species. The last decision seems to be that the beetle should be called *Bruchus obtectus* of Say. The Bean Weevil has never been very injurious in Canada.

The European Bean Weevil (*Bruchus rufimanus,* Sch.) is shown at Fig. 18. This is occasionally imported in seed, but has never established itself as a pest.

Remedies.—As in the case of the Pea Weevil, the best remedy for this insect is the destruction of the weevils inside the beans as soon as possible after the crop is ripe. Fumigation with bisulphide of carbon is the best treatment in every way.

The Bean Aphis

(*Aphis rumicis,* L.).

Attack.—Black plant-lice thickly clustered on the tips of horse beans and broad beans, and also occasionally on other smooth beans, at the time of flowering.

One of the great difficulties of growing horse beans in Canada has been the occurrence of this European species of plant-louse, which is such a serious pest of horse beans in Europe. As this crop is little grown in Canada, small attention has been drawn to it.

Remedy.—The usual practice in Europe is to cut off the tips of attacked plants. upon which the plant-lice are nearly always clustered, leaving the rest of the plant at the time of flowering free. This practice is also beneficial because it overcomes one of the chief difficulties in growing this crop, which is the failure of the pods to develop. This checking of the growth by cutting off the tips causes the flowers to set pods better than if the tips are left on.

The Destructive Pea Aphis

(*Nectarophora destructor,* Jnsn.), Fig. 19.

Attack.—Pale green plant-lice with legs darkened, particularly at the joints, honey tubes very long; clustered in enormous numbers at the tips of the shoots, beneath the leaves and sometimes over the whole plants of field peas, as well as upon the flowering sweet peas and clover. These insects appear suddenly in large numbers and very soon kill the plants by sucking their sap. The winged specimens are rather large for aphids, being about one-eighth of an inch in length, with a wing expanse of nearly one quarter of an inch.

The Destructive Pea Aphis in the summers of 1889 and 1900 wrought enormous injury in North America, practically destroying the whole crop of late peas from the Southern States and over the greater part of Canada, east of the prairies. This insect is now thought to be the same as the Green Dolphin (*Nectarophora pisi,* Kalt.), and is both a clover insect as well as one which occasionally develops, as in the two years named, as a destructive enemy of peas. Fortunately, this is the only recorded instance when such extensive injury has occurred. Prof. E. Dwight Sanderson states that this has been known as one of the worst pests of peas, vetches and clovers in Europe for a hundred years. The aphids leave clover on which they have passed the winter, in spring, and feed upon peas during the summer, returning to clover again in October and November.

Remedies.—This plant-louse is an extremely active species, springing from the pea plants on the slightest touch. This habit was taken advantage of by Prof. W. G.

Johnson, who found that good work could be done by what he called the brush and cultivator method. The peas were planted in rows 24 to 30 inches apart and the vines were brushed backward and forward by boys with pine switches, who went in front of an Iron Age cultivator drawn by a single horse. In this way the plant-lice which left the vines quickly when shaken, were covered as soon as they fell to the ground and destroyed. This remedy was applied over large areas. One operator after trying all methods found that this was the most effective. Forty men were engaged and 600 acres of peas were brushed and cultivated every third day for two weeks, and the entire field was saved, netting the owner from 25,000 to 30,000 cases of peas of 200 dozen tins each. Another method was tried with considerable success by following the brushes with a pan containing coal oil and water. In this way a bushel of plant-lice were caught in each row of peas 125 rods long.

On sweet peas in gardens spraying the vines which showed the presence of the plant-lice by their stunted appearance, with the ordinary kerosene emulsion or with a whale oil soap wash (Remedy 5) proved quite effective.

The Clover-seed Midge

(*Cecidomyia leguminicola,* Lintner).

Attack.—Small legless, pink maggots, which eat out the contents of the clover pods and thus destroy the seeds.

The Clover-seed Midge has been the cause of serious loss to seed growers in all parts of Ontario where clover seed is produced. The life history of the insect is well known. There are two broods in the season, corresponding with the two crops of clover seed. The eggs are laid in the forming flower heads of the clover; when these hatch, the maggots penetrate the seed pods and destroy the seed. When the larvæ are full grown, about the end of June, they leave the clover heads and enter a short distance into the ground to change to pupæ. The perfect insects, forming the second brood, emerge from the ground just as the second crop of clover is coming into flower, and the females at once begin to lay their eggs amongst the forming blossoms. These eggs soon hatch, and about the time the seed is ripe the maggots leave the clover and enter the ground to pass the winter, whence they emerge again the next spring just at the time the clover comes into flower.

Remedy.—The practice of feeding off or mowing the first crop of clover before June 20, has been found the most satisfactory remedy by all who have tried it. The object of this is to destroy the immature maggots, which naturally reach full growth about the end of June and from which the second brood, which attacks the seed of the second crop, is produced.

The Clover Leaf Weevil

(*Phytonomus punctatus,* Fab.).

Attack.—Greenish white, slug-like grubs tapering to the end of the body, eating the leaves of clover at night, becoming full grown in June and spinning oval open lace-work cocoons of a yellowish green colour, about the bases of the stems and on the ground beneath the plants. The beetles appear in July and August and are heavy-bodied oval beetles one-third of an inch long, with short thick snouts. The colour is brown with narrow dotted gray lines on the wing covers and a broad pale stripe on each side. The beetles attack the second crop of clover in August and do as much harm as the larvæ in June. The eggs are laid in autumn and the larvæ become partially grown and winter over among the roots of the clover, and in the old clover stems. When growth begins in spring, they crawl up the stems and attack the leaves.

The Clover Leaf Weevil, also known as the Large Clover Weevil and the Punctured Clover Weevil, has not so far proved a serious enemy to clover crops in Canada,

although the beetles have been taken in several places by collectors. The species is commonest in the counties north of Lake Ontario; but the beetles were extremely abundant in Victoria, British Columbia, at the end of July, 1902.

Remedy.—The only remedy for this insect is the ploughing down of badly infested fields in May. Fortunately this is seldom a severe loss to a farmer on account of the great fertilizing value of ploughed down clover. As a matter of fact, this step is seldom necessary because when the grubs are found in large numbers they are almost invariably destroyed by a parasitic fungus, *Entomopthora sphærosperma,* Fres. Attacked larvæ crawl to the tops of grass stems, and, curling their bodies round the stems turn to a pallid white colour and die. A few days later the body decays and the spores are given off causing a very infectious disease among other larvæ.

The Green Clover Weevil

(*Phytonomus nigrirostris,* Fab.).

Attack.—Larvæ similar to those of the previous species, but much smaller and feeding for the most part in the stipules of the upper leaves and in the young forming heads. Much more abundant and more destructive to clover in Canada than the Clover Leaf Weevil.

Although the larvæ frequently appear at the same time and together with those of the larger species, they remain in the clover longer, almost up to the end of June. The perfect beetles appear in July and in autumn and pass the winter as such hidden away beneath dead vegetation and in moss. They are somewhat of the same shape as the Clover Leaf Weevil, but only one-third of the size, of a bright green colour with a proportionately longer beak, which is black. The white cocoons are often spun inside the bracts of the clover heads. The summer brood appears in July and is of a brown colour washed with green, but much less green than the autumn brood.

Remedy.—When clover shows the presence of the weevil, it should be fed off or cut early, when the pupæ and larvæ will be destroyed. Clover lands treated for the Clover-seed Midge will also be freed of this pest at the same time.

The Clover Seed Caterpillar

(*Grapholitha interstinctana,* Clem.).

Another insect which sometimes occurs with the above named clover weevils, and which is controlled by the same remedy, but which has never done very much harm in Canada, is the Clover-seed Caterpillar. The greenish-white larvæ a quarter of an inch long, live in the heads of the clover, destroying the seed by gnawing into the small pods at the base. The delicate cocoons are spun in the clover heads. There are two broods, the moths occurring in June, in July and in August. The moth is a little silvery gray creature with seven or eight fine white dashes along the front margin of the wings and two curved larger stripes on the inner margins, which meet when the wings are closed, forming two crescent-shaped bars, one inside the other, with the tips pointing to the outer margin of the wings. These may be easily recognized by their habit of running in circles when they settle on the leaves. The eggs are laid on peas as well as on clover.

The Clover Root-borer

(*Hylesinus trifolii,* Muller = *Hylastinus obscurus,* Marsh), Fig. 20.

Attack.—Small brown beetles, inch long, shown magnified in the figure, which bore into the roots of clover and deposit eggs there; these eventually turn to white grubs which destroy the root of the clover plant.

The life history of the Clover Root-borer is as follows: Early in spring the mature beetles emerge from the ground, where they have passed the winter in the roots of the clover plants, which they had destroyed the previous season. After pairing, the female bores a cavity in the crown of the root, and deposits there about half a dozen small white eggs. These hatch in about a week and eat their way down into the root, hollowing it out, as shown in the figure. The burrows are filled up with the excrement of the small white grubs (fig. *b*), which when full grown are only about 1-10th of an inch in length. These change to chrysalids, and in September the perfect beetles may be found in the roots.

Remedy.—No better remedy has been suggested than the ploughing down of clover when it is found to be infested. As a rule, this is not detected until the second crop is noticed to fail suddenly. In infested districts the fields should be examined frequently, and, if any indications of the weevil are found, the clover should be ploughed under as soon after the first cutting as there is a good growth on the ground.

The Army Worm

[*Heliophila* (*Leucania*) *unipuncta,* Haw.], Figs. 21, 22.

Attack.—Brown, or sometimes blackish, striped caterpillars eating the leaves and stripping the stems of grasses and many other low plants at night. When full-grown, over an inch and a half in length, and, when occurring in large numbers, migrating in bodies from one food patch to another. On reaching full growth the caterpillars burrow into the ground and turn to light brown chrysalids, from which in about two or three weeks the moths emerge. These are of a warm, satiny brown colour, sprinkled with minute black specks, and with a small but distinct white spot a little beyond the middle of each upper wing. When the wings are closed, the moth measures about an inch in length. They are nocturnal and extremely active.

There are in Canada two broods of the Army-worm in the year, the caterpillars of the second brood appearing towards the end of July. This brood is the one which in some years attracts attention by its depredations. The Army-worm is a native insect occurring every year among grasses in low ground. It is only in years of exceptional abundance that the caterpillars spread from these places and attack crops. The insect occurs right across the continent, and injuries have been recorded from various places; but, owing to the large numbers of parasites which always accompany an excessive increase in the caterpillars, the Army-worm is very seldom abundant in the same place for two successive years.

Remedies.—Army-worms may be prevented from marching from one field to another by ploughing a deep furrow across their path. This should be cleared out so as to leave the edge nearest to the field to be protected perpendicular. Along the trench so formed pits may be dug 12 feet apart. When the caterpillars come to the trench, they fall in and, being unable to climb up the opposite side, march along the furrow and fall into the pits, where they may be destroyed by covering them with earth and tramping it down, or with a liberal dose of coal oil and water. In case any of the Army-worms cross the trench, a strip of the plants on the opposite side should be dusted or sprayed with a strong Paris green mixture, one part in 25 of flour, ashes or land plaster, applied after the plants have been sprayed with water, or when covered with dew; or these plants may be sprayed with Paris green and water, one ounce of poison to every five gallons of water.

The Cottony Grass Scale

(*Eriopeltis festucæ,* Fonsc.), Fig. 23.

Attack.—Compact oval tufts like pieces of cotton wool (as shown life-size in the figure) attached to the stems and blades of grasses and conspicuous during autumn

and winter. These are egg sacks of a species of scale insect. They are frequently so abundant in the Maritime Provinces as to cause alarm to farmers, and there is no doubt from their numbers that, while the scale insects are active, they must cause much reduction of hay and pasture crops, by sucking the sap from the stems.

Up to the present this insect has only been observed in injurious numbers in Nova Scotia and Prince Edward Island.

The Cottony Grass Scale passes the winter in the egg condition inside the closely-felted cottony sacks. The young hatch in spring and feed on the leaves and stems of grasses, becoming full grown in July. Towards the end of the month the females lay their eggs in conspicuous cocoon-like sacks and then die, their shrivelled bodies showing at one end of the egg-sacks.

Remedy.—As the insect passes the winter in the egg state upon the old grass, the burning over the meadows and pastures late in autumn or before the growth begins in spring, gives an easy method of destroying this scale, should it at any time multiply so as to become injurious.

II. INSECTS INJURIOUS TO ROOT CROPS AND VEGETABLES.

Cutworms, Figs. 24, 25.

Attack.—In spring, as soon as seedlings appear above the ground or annual plants are set out, many are eaten off at the surface of the ground by dull-coloured caterpillars from half an inch to an inch and a half in length, which come out at night and devour almost all kinds of young vegetation, cutting it off as described above and often dragging part beneath the surface, where they lie hid during the day.

Cutworms are the caterpillars of active dull-coloured moths belonging to the Noctuidæ, or Owlet moths, of which there are upwards of four hundred different kinds in North America.

These moths are much alike in shape and in the arrangement of the more noticeable markings, and are for the most part dull-brownish or grayish moths about 1½ inches across the spread wings, which hide by day like the larvæ, and fly only by night. The moths begin to appear about the middle of June and fly till the end of the season. Most of the kinds are single-brooded, the caterpillars passing the winter half grown, and doing most damage to vegetation in spring.

The caterpillars of the different kinds are on the whole very similar in appearance and habits, being smooth, greasy-looking caterpillars of some dull shade of colour similar to the ground in which they hide during the day. Their habits are almost always nocturnal; but, when they occur in large numbers, they feed by day as well as by night, owing to the reduced food supply consequent upon their ravages.

The eggs from which cutworms hatch are laid by some species in the autumn and by others in the spring or summer. As a consequence, cutworms of all sizes can be found in spring; for these insects, according to the species, may pass the winter as a perfect moth, a chrysalis, a partially grown caterpillar, or an egg. The ravages of the young caterpillars, which hatch in the summer and autumun, are seldom noticed then, on account of the abundant vegetation at those seasons. In spring, however, not only are the caterpillers much larger and capable of more mischief, but the land is then clear of all weeds and vegetation other than the crop, and when the cutworms come from their winter retreats, there is nothing for them to eat but the farmer's early crops. Cutworms are particularly troublesome in gardens, cutting off young cabbages, tomatoes, beans and annual bedding plants. When the caterpillars are full-fed, they burrow into the ground to a depth of a few inches and turn to brown chrysalids inside a smooth cell or a light cocoon.

Injuries by cutworms in most seasons may be expected to stop by the end of June; but different species vary in the time they stop feeding, and the knowledge as to the exact species which is destroying a crop is frequently of great service to a farmer, so

that he may know when the caterpillars are full-grown and what their habits are, so that he may know for certain when it will be safe for him to resow his land, which has been ravaged by these insects. Some of the early maturing species, as the Black Army-worm (*Noctua fennica,* Tausch.), which frequently strips clover and pea fields early in the spring, stops feeding early enough for it to be safe for the farmer in many instances to apply no remedy whatever. The caterpillars, when full fed, burrow into the ground, and the crop springs up again, frequently catching up and showing no diminution in yield. Thus, a farmer who knows the habits of this insect is saved from going to the expense and trouble of applying a remedy. Other species, however, mature so late in the season that it would be unsafe and unprofitable to resow the land without special treatment to destroy the cutworms.

Cutworms are, on the whole, about the most troublesome insect enemies the market gardener has to deal with; and every year they are the cause of much destruction both in gardens and on farms. Among the more troublesome kinds which farmers should endeavour to know by sight and remember the life-histories of are: the Black Army-worm (*Noctua fennica,* Tausch.), mentioned above; the Red-backed Cutworm (*Paragrotis ochrogaster,* Gn.), which is probably the widest-spread and most regularly occurring injurious species we have. It has also a wide range of food plants, attacking almost all succulent forms of vegetation, but showing a curious preference for certain kinds in different localities. In Manitoba occasionally wheat fields are stripped and oats growing alongside are left untouched. In other localities the exact opposite to this is the case, and again in others lamb's-quarters and other weeds will be cleared from the ground and the grain left untouched. The Dark-sided Cutworm (*Paragrotis messoria,* Harr.) is a very common species, particularly troublesome to onions and young vegetables in gardens; but, like the Red-backed Cutworm it attacks almost every herbaceous plant. The Spotted Cutworm (*Noctua c-nigrum,* L.) sometimes does harm to fields of turnips, tomatoes, and rarely to oats and peas, as late as the end of July. Another very late cutworm is the Clover Cutworm (*Mamestra trifolii,* Esp.), which has on one or two occasions occurred in excessive numbers and destroyed whole fields of peas, turnips and beets in August. The Variegated Cutworm (*Peridroma saucia,* Hbn.) is a large and late species which did an enormous amount of harm on the Pacific coast in 1900; the greater part of the injury was done during the month of July, and almost all low growing crops were devastated. This caterpillar has also the bad habit of climbing trees and destroying the foliage in the same way as the White Cutworm (*Paragrotis scandens,* Riley). This last named passes the winter half grown, and is in some places and on sandy lands extremely destructive in early spring. Western species, the appearance and habits of which should be known to those who wish to fight them successfully, are *Chorizagrotis auxiliaris,* Grt., *C. agresis,* Grt., and *C. introferens,* Grt., which occur throughout the prairie regions and have caterpillars with the same habits and extremely similar in appearance to the Red-backed Cutworm. Neither these nor *Paragrotis perexcellens,* Grt., and *Dargida procinctus,* Grt., which frequently injure crops in British Columbia, have so far received no distinctive English names; but fortunately the habits of cutworms are such that general principles for applying remedies may be adopted for the protection of most crops. There is, however, much confusion in the reports of injuries by cutworms, and unless specimens are actually received and reared to the perfect insect, it is almost impossible, from reports of correspondents, to be sure as to the exact species to which injury should be attributed.

Remedies.—(1.) Clean Farming.—The keeping down of all weeds and the burning up of all haulms, stems of reaped crops and refuse, as early as possible in the autumn after crops are reaped, will destroy many eggs and prevent the deposition of others by presenting no suitable place for the moths to lay their eggs. The eggs are laid in autumn or spring, and such places are chosen by the moths as where there will be an abundance of food for the young caterpillars on hatching.

(2.) Traps.—Large numbers may be destroyed by placing between the rows of an infested crop, or at short distances apart on infested land, bundles of any succulent

weed or other vegetation which has been previously poisoned by dipping it, after tying in bundles, into a strong mixture of Paris green, 1 oz. in a pail of water. The cutworms eat the poisoned plants, then bury themselves and die. In hot, dry weather these bundles should be put out after sundown, and a shingle may be placed on each to keep it from fading.

(3.) Banding and wrapping.—

(*a*) It will be found to well repay the trouble and expense to place a band of tin around each cabbage or other plant at the time of setting out. These may very easily be made by taking pieces of tin 6 inches long and 2½ wide and bending them around a spade or broom handle so as to form short tubes. In placing them around a plant the two ends can be sprung apart to admit the plant, and then the tube should be pressed about half an inch into the ground. I have found this a useful means of disposing of empty tomato and other cans. To prepare these easily, they need only be thrown into a bonfire, when the tops and bottoms fall off and the sides become unsoldered. The central piece of tin can then be cut down the centre with a pair of shears and forms two tubes.

(*b*) Wrapping a piece of paper round the stems of plants when setting them out will also save a great many.

Hand-picking or digging out the cutworm whenever a plant is seen to be cut off should, of course, always be practised.

(4.) Poisoned Bran Mash.—The most remarkably effective remedy against cutworms is the poisoned bran mash which has lately come into such wide use. This is made by mixing half a pound of Paris green with fifty pounds of slightly moistened bran. In making this, it is best first to dampen some of the bran slightly with water containing a little sugar. After mixing thoroughly, add the Paris green by dusting it on the surface and stirring all the time. We have found that when Paris green is added to perfectly dry bran, owing to its weight, it will sink at once to the bottom when stirred, in the same way that it does in water. Half a pound of Paris green is enough to poison fifty pounds of bran, although double this amount may be used. If the mixture is too wet, more dry bran should be stirred in until the mixture will crumble easily and run through the fingers without adhering.

When required for garden use, all that is necessary is to sprinkle a little of the poisoned mixture by hand around such plants as are liable to attack. When crops are planted in drills or in rows, a convenient way is to make the mixture rather dry and then distribute it by means of a Planet Jr., or other wheel seeder. In field practice, among such close growing crops as standing grain, which are sometimes injured by the Red-backed Cutworm, the poisoned bran remedy is also serviceable. The mixture can be distributed by means of a paddle or shingle and can be thrown easily to a distance of twenty feet. When distributed in this way, there is much less danger of chickens and birds picking it up than if it is placed in lumps.

The question of danger from the use of this poisoned bait is one which must be considered. It is frequently inquired about by correspondents, and some instances of the poisoning of poultry where it has been used, seemed to be justly attributable to their having eaten some of it. As a rule, there is little danger from this cause. The quantity used is so small that it is not noticed by poultry; and then, in gardens, poultry do so much harm to plants that they should never be admitted at the time of year when cutworms occur injuriously and only at special times of the year when there are no crops to injure. If, however, there should be a bad infestation by cutworms and there is no means of barring out or driving away the chickens, the owner of the crops must decide whether he will lose his crop or take special means of protecting his chickens. The experience of a great many people who have used this remedy without taking any special precautions, is that injury to domestic animals is extremely rare; and, although I have been on the watch for any trouble of this sort for many years, I do not know of a single instance when poultry have been poisoned, without doubt, by eating poisoned bran put out for cutworms. However, there will be many occasions when plants in

gardens may be protected by putting out the poisoned bran in small heaps and then covering these up with a piece of shingle or some other covering, so that the material cannot be got at by stray chickens and other poultry.

It has also been asked whether there is any danger of plants absorbing Paris green from this mixture when placed near their roots. In reply to this, it is only necessary to point out that Paris green is practically insoluble and therefore cannot be absorbed by the plant.

Root Maggots, Figs. 27, 28.

Attack.—Small white maggots which bore into the roots of radishes, freshly set out cabbages, and into the bulbs of onions, and sometimes also injure the roots of beans and Indian corn.

The Cabbage or Radish Maggot, and the Onion Maggot, which for all practical purposes may be treated of here as the same species, cause great loss in crops of cauliflowers, early cabbages, turnips, radishes and onions, almost every season.

The maggots which are found attacking cabbages, radishes, cauliflowers and turnips, and those in onions, and in beans and corn, are very similar. but they belong to three different species, *Phorbia brassicæ*, Bouché, attacking plants of the cabbage family, *Phorbia ceparum*, Meig., infesting onions, and *Phorbia fusciceps*, Zett., (Fig. 27) injuring beans and corn.

Corn sown during a cold, wet period by which germination is unduly delayed, is very liable to be attacked by the Corn-seed Maggot (*P. fusciceps*). In such cases it is well to wait for warm weather to re-sow and then push on the crop with a light dressing of nitrate of soda, 200 lbs. to the acre.

The perfect flies of all these maggots are very similar to the ordinary observer and may be described as slender flies, somewhat smaller than the ordinary house fly, which fly about close to the ground and lay their white eggs on the stems of the young plants. Here after a few days the maggots hatch and work their way down beneath the soil, where they lie close to the root or burrow into it, tearing the tissues with their hook-like mandibles and living on the sap, thus soon reducing the root or stem to a rotten mass. When full grown these maggots turn to reddish brown puparia in the soil close to the roots. The exact number of broods of these maggots which may be found in a season seems to be rather complicated by the overlapping of broods, and the delay in issuing of some individuals of each brood; but practically it may be said that cabbage and radish maggots do by far the greatest amount of harm during the month of June, and early in July, and in many years their injuries are slight after that period. With onions the injury continues throughout the season and is most noticeable in June, August and September. The injury to beans and Indian corn is only in spring, and, as a rule, is confined to plants which have been weakened by the seeds being planted too deeply or by late frosts. However, in seasons of excessive abundance cabbage and onion maggots may be found all through the growing season, and cabbages and cauliflowers are occasionally injured in autumn by the maggots attacking the heads of the plants.

Remedies.—Up to the present time it cannot be claimed that any perfectly efficacious remedy has been discovered for root maggots. In certain years they seem to be so extremely abundant that even the best remedies merely seem to prolong the lives of the plants, and only a very small proportion of a crop can be saved. In ordinary years, however, much can be done to protect crops liable to attack, and the following are the remedies which have given the best results :—

For Onions.—White hellebore (Remedy 3) dusted along the rows once a week from the time the young plants appeared above the ground gave comparatively clean onions, very few being attacked. Fresh gas lime broadcasted over onion fields at the rate of two hundredweight to the acre had a similar effect; but, where the caustic lime came in contact with the young onions, they were burnt out. A light dressing, between the

rows of onions, of the same material gave almost as good results as where it was distributed over the whole field. When onions have begun to form their bulbs, the earth may be hoed or brushed away right down to the roots, and in some years the maggots do not penetrate the bulbs. As soon as the earth is hoed away in garden practice, a dusting along the rows with white hellebore makes the protection more complete.

Dressings of salt, Paris green and plaster, and wood ashes have been found useless in protecting onions from the attacks of root maggots.

For Cabbages.—(1). Tarred Paper Disks.—Pieces of ordinary tarred paper three inches in diameter, with a slit running to the centre so as to allow of their being placed around the stems of young cabbages and cauliflowers at the time of planting, and pressed down close to the ground, will prevent to a large measure the flies from laying their eggs on plants so protected, or will kill the young maggots.

(2.) Insect Powder.—About half a tea-cupful of a decoction of pyrethrum insect powder (four ounces to a gallon of water), or of white hellebore (Remedies 3 and 4) of the same strength poured around the root of each plant, after drawing away the earth, right down to the roots, will destroy any maggots which may have started to work. The earth should be put back again and the plants well hilled up, when new rootlets will soon be formed. A light sprinkling of nitrate of soda or some special fertilizer will encourage a quick growth and much help the plants to overcome attack. Dressings of one ounce to the square yard may be used for this purpose. Cabbage plants should be examined late in June to see if the maggots are at work. The earlier the treatment with insect powder or white hellebore is applied the more effective it will be. If the mixture is applied to the roots with a force pump, although more liquid is consumed, it has the advantage of dislodging many of the maggots so that their injuries cease at once.

(3.) Cheese-cloth inclosures.—A very effective and practical means of procuring early radishes, cabbages and cauliflowers, perfectly free from root maggots, is by growing them beneath cheap frames made of light wood covered with cheese-cloth. A convenient size for small beds is 8 feet long, 2 feet wide and 2 feet high. This frame can be made for about 25 cents, of one and a half inch square wood, nailed together at the corners, and with the cheese-cloth tacked on the outside. In such a frame five cauliflowers and two rows of radishes have been grown to perfection. The frame was kept on from the time the young plants came up until the radishes were pulled.

Cauliflowers were sufficiently advanced to require no further protection and the frames were removed about the first of August.

For Radishes.—The maggot which attacks the radish is the same species as also attacks cabbages and turnips, the severity of attack on these different crops being about in the order in which they are named, so that in years of light attack radishes will draw off injury from the cabbages.

Injuries to turnips are seldom severe, and in most instances a crop shows little sign of this attack in autumn, even in seasons when the maggots may have been found in considerable numbers in the spring.

(1.) The Cook carbolic wash (Remedy 6), consisting of one quart of soft soap, or one pound of hard soap, in a gallon of water, with half a pint of crude carbolic acid added, and the whole boiled together for a few minutes, to make the stock emulsion, has proved over and over again an excellent remedy for radish maggots. The stock emulsion can be kept in a closed vessel, so that dust and rubbish will not fall into it, and, when required for use, one part of this mixture by measure is added to fifty of water, and should be sprayed directly upon the growing plants from the time they appear above the ground, once a week until ready for the table.

(2.) White hellebore (Remedy 3), dusted along the rows of radishes once a week from the time they appear above the ground, has given good results in most years.

From 2 years' experience with the cheese-cloth coverings, I have no hesitation in recommending these to amateur gardeners, however small their gardens may be, as a sure means of obtaining perfectly clean, as well as early, radishes and cauliflowers of the very best quality, at a comparatively light expense.

For Beans and Corn.—Injury to these crops in Canada is a rare occurrence. The only remedy which can be suggested, is to sow these crops in good season in well prepared soil and not deeper than one or two inches.

The Small White Cabbage Butterfly
(*Pontia rapæ*, L.), Fig. 26.

Attack.—Velvety green caterpillars, commonly known as Cabbage Worms, about an inch in length, with a broken yellow line along each side, and an unbroken one down the middle of the back. At first eating the outside leaves, but eventually boring right into the head of the cabbage. These, after three or four weeks, produce the white butterflies so common in gardens.

This injurious insect, which was imported into Canada about 1859, has now spread right across the Dominion, and is every year the cause of considerable loss, not only to cabbages but also to turnips and other plants of the same family. It is, however, one of the easiest of the well known insect pests to control. There are two broods during the growing season, and sometimes a late supplementary one, of which, the caterpillars are found as late as November. Farmers and gardeners should watch for the first appearance of the larvæ and apply the remedy promptly. The eggs are laid by the female butterflies on the leaves.

Remedy.—The caterpillars can be destroyed easily by dusting the plants with a mixture of one pound of pyrethrum insect powder (Remedy 4) and four pounds of cheap flour. Mix the whole together and keep it in a tightly closed canister or jar for 24 hours. The powder is then ready for use and may be dusted over the cabbages either with a cheese-cloth bag tapped lightly with a slender stick, or from one of the various insect guns, or dusters, now sold by seedsmen. The advantage of this remedy over many others which are recommended is that, although insect powder is so deadly to caterpillars and most insects, it is quite harmless to human beings and the higher animals.

The rather prevalent custom of using Paris green and other arsenical poisons on cabbages and other vegetables, must be condemned as being very dangerous without any commensurate advantage.

The Diamond-back Moth
(*Plutella maculipennis*, Curtis = *Plutella cruciferarum*, Zell.), Fig. 30.

Attack.—Small, green, exceedingly active caterpillars about one-quarter to three-eighths of an inch in length, which attack the leaves of cabbages, turnips, &c., eating numerous small holes through the younger leaves, and irregular blotches from the under surface of the older leaves. When disturbed they run backwards ,wriggling their bodies violently from side to side, and, by means of a silken thread, fall to the ground, where they lie quite still.

The caterpillar of the Diamond-back Moth is in some years a serious pest of cabbages, turnips, rape and almost all other cruciferous plants. In years of bad attack the whole plant soon turns white from the green cellular matter having been eaten away, and the plants dry up. It is probable that there are two regular broods in the year; but occasionally in late autumns some of the second brood emerge and produce a third supplementary brood, part of which comes to maturity, and the pupæ winter over and form part of the spring brood of moths. The effects of the first brood are seldom noticed until about the first week of July, and, when seen, should at once be attended to. The active caterpillars can be recognized by their spindle-shaped bodies and their wriggling motions when disturbed. When full grown, they spin open network cocoons on the lower sides of the leaves, through which the black-lined white pupæ can be easily seen. The larval stage in summer lasts from three weeks to a

month, and the pupal stage, about a fortnight. The perfect moth is a slender little creature very variable in size and markings. A well marked example is shown in the figure. The size of the moth is shown by the hair line in the middle of the figure. The general colour is ashy gray with a stripe of light somewhat diamond-shaped marks on the back when the wings are closed.

The occurrence of the Diamond-back Moth in large numbers is fortunately very irregular. This is undoubtedly due to the large number of parasites which always appear with a serious attack. This is a fortunate circumstance, as it is a difficult insect to control. The injuries are generally more serious in hot, dry seasons.

Remedies.—Remedies which have given good results are: (1.) Dusting the infested plants with a dry Paris green mixture (Remedy 1), using preferably lime or wood ashes as a diluent. In England, where soot from soft coal can be easily obtained, this substance mixed with equal quantities of slaked lime is found to give the best results. (2.) Kerosene emulsion (Remedy 2), sprayed well under the leaves, has given excellent results in garden practice. (3.) As a supplementary treatment, inducing a vigorous growth with light dressings of nitrate of soda, or some special fertilizer, are most useful. (4.) Several reports mention the advantage of watering thoroughly the attacked plants, where this is practicable. (5.) As a preventive measure, care should be taken to keep down all weeds and plants of the mustard family and to destroy in autumn all surplus plants of a crop which has been attacked. In this way the over-wintering brood will be destroyed.

The Cabbage Plusia
[*Autographa* (*Plusia*) *brassicæ*, Riley], Fig. 31.

Attack.—Pale green caterpillars, about an inch and a quarter long, striped with longitudinal whitish lines, walking like the loopers (the larvæ of the geometers), owing to their only having three pairs of prolegs at the end of the body. These caterpillars are very voracious, and when full grown they spin gauzy silken cocoons on the leaves.

The Cabbage Plusia, or Cabbage Looper, is particularly destructive to cabbages, lettuces and some other plants when it occurs; but, fortunately, its injuries to crops in Canada are very rare. It is, however, an insect which at any time may become as serious a pest in Canada as it has proved in the northern United States, close to our borders. There are probably two broods in a season.

Remedies.—It is claimed that this enemy of the cabbage is very much more difficult to destroy than the ordinary 'cabbage worm' of Canada, which is the caterpillar of the small white cabbage butterfly. Dusting the plants with Paris green and lime (one pound to twenty of the diluent) will kill the caterpillars early in the season; but it requires frequent applications and some implement by which the powder can be driven up beneath the leaves, where the caterpillars mostly feed. If a liquid spray is used containing arsenical poisons, one pound of soap should be added for every twenty gallons of wash. In addition to the above, another species belonging to the same family and styled, 'The Eyed Cabbage-looper' (*Autographa precationis*, Gn.), by Mr. Chittenden, in Bulletin No. 33, n.s., 'Some Insects Injurious to Vegetable Crops,' U. S. Bureau of Entomology, is extremely common in Canada, and may at any time develop into an enemy to the farmer and gardener. The life history is similar to that of the Cabbage Plusia, and the same remedies may be applied. A figure of this common insect is shown herewith. (Fig. 29).

The Zebra Caterpillar
(*Mamestra picta*, Harr.), Fig. 32.

Attack.—Rather large handsome caterpillars, when mature about two inches in length, velvety black on the back, beautifully ornamented with two golden yellow

stripes on each side of the body, which are connected by narrow lines of the same colour; the head and feet reddish brown. There are two broods of this insect every year. The moths of the first brood appear during May and lay their eggs in large clusters on the under sides of leaves of many different plants. These hatch in a little more than a week; and the young caterpillars for a time feed gregariously, devouring all the green cellular portion and making large conspicuously white patches on the leaves. As they grow larger they separate and feed singly. The caterpillars of the first brood are full grown about midsummer, when they spin slight cocoons just beneath the surface of the ground, and the moths emerge about the first week in August; they are rather dull-coloured, purplish brown moths with white under wings, expanding about one and a half inches across the opened wings.

The eggs of the second brood are laid throughout August and into September, and the caterpillars are to be found, as a rule, later than those of most of our moths. Being conspicuously coloured, they are often noticed crawling about, looking for food late in the autumn, when most kinds of plants have been frozen and killed. The winter season is passed in the chrysalis state beneath the ground.

The crops most attacked by the Zebra Caterpillar are turnips, cabbages, peas, clover and potatoes.

Remedies.—Spray affected plants with Paris green, 1 oz. in 10 gallons of water; or dust with insect powder (Remedy 4), or white hellebore (Remedy 3), or Paris green and lime 1 lb. to 20 of the diluent.

The Purple-backed Cabbage Worm
[*Evergestis (Pionea) straminalis,* Hbn.].

Attack.—Slender bristly caterpillars, tapering to each end, purplish on the back; with the head, two spots on the second segment, and a small plate at the end of the body black; measuring when full grown three-quarters of an inch long. These are found under the leaves of cabbages and turnips in July and in September and October. These caterpillars are most troublesome in the Maritime Provinces, where every year considerable injury is done to crops of turnips late in the season, the caterpillars congregating on the crowns of the turnips and eating cavities into the roots, as well as consuming the leaves and reducing them to skeletons. Sometimes whole fields of turnips and cabbages are destroyed.

Injury by the Purple-backed Cabbage Worm is occasionally serious in the eastern provinces, and their work is sometimes supplemented by the half-grown cutworms of several species which pass the winter in the larval condition. There are few references to the species in literature; but, as the moth is common over a very wide area in Canada, it is probable that the injury is more considerable than is supposed. There is an allied species known as the Cabbage Pionea, which is troublesome to cabbage fields in the eastern United States, the caterpillars of the two species being very much alike. The chief character by which the Purple-backed Cabbage Worm can be recognized from the larva of the Cabbage Pionea, is that its head is shining black, while that of the last-named is yellowish. The moth of the Purple-backed Cabbage Worm is a neat little species, expanding seven-eighths of an inch; the upper wings are of a pale satiny yellow, marked distinctly with a heart-shaped discal spot, two distinct transverse waved lines across the centre of the wing, the inner of which runs through the middle of the heart-shaped spot, and two less distinct lines, one at the base of the wing and the other close to the tip. There is also a conspicuous dark blotch bearing a white crescent outwardly towards the tip of the wing. The lower wings are silvery white, with a clear black margin and a narrow submarginal line inside this. The fringes of the upper wings are gray; of the secondaries, white.

There are two or three broods of this insect in the season; the moths of the first brood, which passes the winter as a chrysalis, appearing in spring towards the end of June, and those of the last brood laying eggs from which caterpillars are found in October and November. This last brood is by far the most injurious.

Remedies.—For the early broods, when found upon turnips, spraying with Paris green or dusting the plants with Paris green and some dry powder, will answer (Remedy 1). For the last brood, when it attacks cabbages, insect powder (Remedy 4) must be used, as there would be danger of using arsenites upon cabbages which had been eaten into by the caterpillars. In the case of turnips, the quantity reaching the roots would be so small and there would be so many opportunities for the poison to be washed off, that Paris green or some other active poison could be used, even up to the end of the season.

The Colorado Potato Beetle

[*Leptinotarsa* (*Doryphora*) *decemlineata*, Say], Fig. 36.

Attack.—About the end of May the mature beetles of the well known Colorado Potato Beetle, usually known as the Potato Bug, come out from their winter quarters beneath the soil, and at once begin devouring any potato plants which may have appeared above the surface. The sexes pair at once, and the bright orange eggs are laid beneath the leaves in clusters of half a dozen to about fifty. In about a week the dark-coloured larvæ hatch, spread out over the foliage, and at once attack the leaves. In four or five weeks they become full grown and enter the earth, where they change to orange-coloured pupæ in smooth oval cells two or three inches below the surface. In about a fortnight a new brood of beetles appears, which attack the plants in company with belated larvæ of the first brood. This second brood becomes mature in a rather shorter time than the first, and the third brood comes from eggs laid by them. The third brood emerges in September and is most noticeable, because by that time there are few potato tops left in the field, some fields having been dug and others bared of foliage by fungous diseases. The beetles, having very little food, wander about and are found on sidewalks, paths, &c. After a time they burrow into the ground and remain there for the winter. After the first brood the two other broods become very much confused. This is due chiefly to the long period over which the females continue laying clusters of eggs, so that the insect in all stages may be found during the summer months.

The Colorado Potato Beetle is particularly destructive in all parts of Canada east of the prairies, and is occasionally so in Manitoba and in the foothills of the Rockies. So far, it has not been recorded from British Columbia.

Remedies.—The standard remedies for the Colorado Potato Beetle are the various arsenical poisons, the most useful of these are Paris green and Arsenate of Lead, both of which may be used alone or what is far better, and now a more general practice everywhere, mixed with the Bordeaux mixture (Remedy 7). Bordeaux mixture has also a special effect in destroying the Cucumber Flea-beetle, *Epitrix cucumeris*, Harris, which is frequently a serious enemy to potatoes, tomatoes, and egg plants, and has on occasions been even more destructive to these plants than the larger and better known species. If the plants are kept well sprayed with Poisoned Bordeaux mixture, the first application in the beginning of June, then early in July and about August 1st, 15th and 31st, not only will all of the biting insects which occur on these plants be destroyed, but several fungous diseases including the Early Rot and the terribly destructive Potato Rot, will be prevented.

Blister Beetles,

Fig. 33.

Among the usually unimportant injuries to potatoes which on occasion become more extensive and involve large areas, are those due to swarms of Blister Beetles, long, cylindrical shaped beetles with soft bodies, which fly to fields and swarming over the potatoes devour the leaves rapidly. As a rule, these swarms remain only for a short time and then pass away.

A remedy which has been adopted successfully consists of driving the swarms from a crop by several people walking across it with branches or other conspicuous objects in their hands, waving them from side to side and driving these easily disturbed beetles ahead of them until they come to the edge of the crop, where they will disperse and seldom return. It is undesirable to destroy the Blister Beetles if this can be avoided, because in their larval form they are predaceous parasites on the eggs of grasshoppers; but, as in the case of nearly all leaf-eating insects, these can be destroyed by spraying the crops with a poisonous mixture such as one of the arsenites (Remedy 1). Prof. F. M. Webster has found that crops sprayed with Bordeaux mixture (Remedy 7) are not attacked by Blister Beetles and as all potato crops should be sprayed with Bordeaux mixture every year, there is no reason why they should suffer from these insects. In addition to potatoes, many other crops and plants, particularly members of the pea family, are attacked by different species of Blister Beetles.

Species which have at different times been the cause of considerable injury to potato crops are the Black Blister Beetle (*Epicauta pennsylvanica*, DeG.), the Spotted Blister Beetle (*Epicauta maculata*, Say) and the Gray Blister Beetles (*Macrobasis unicolor*, Kirby, and *Epicauta cinerea*, Forst.).

The Four-lined Leaf-bug
(*Pœcilocapsus lineatus*, Fab.), Fig. 34.

A somewhat unusual attack on potatoes, but one which always attracts attention, is by the Four-lined Leaf-bug, which is easily recognized by the tips of shoots and the foliage being curled up and spotted with dark spots nearly as big as the head of a pin. and the subsequent drying up of the injured parts. This leaf-bug attacks many kinds of plants in gardens but has a special liking for mint, sage, gooseberries and currants.

Remedies.—(1.) Spraying the nymphs or partially developed bugs which cannot fly, with a strong kerosene emulsion (1 to 6) ; (2.) The jarring or beating of the nymphs and perfect insects from the attacked plants into open tins containing coal oil and water; and (3.) The destruction of the eggs, which are always laid in the twigs of bushes, particularly the currant, near the tips; these are white, and, as they protrude slightly through the bark, when once seen they are easily recognized again, and thus this attack may be controlled to a large measure by winter pruning.

The Cucumber and Potato Flea-beetle
(*Epitrix cucumeris*, Harr.), Fig. 37.

This minute beetle, which does not exceed one-twentieth of an inch in length, is black, covered with short fuscous hairs, and is much more frequently complained of as a potato pest than as an enemy to any other crop. It is sometimes, in hot, dry summers, one of the worst enemies of the potato, eating many small holes through the leaves and reducing them so much that they are unable to perform their functions. The best remedy for this insect appears to be spraying the vines with Bordeaux mixture. This treatment has given far better results than spraying with Paris green. The practice, too, of spraying potatoes with Bordeaux mixture is also an excellent one, as stated above, being an effective preventive for the Early Blight of the potato, as well as of the much more destructive Potato Rot or Late Blight.

The Five-spotted Hawk-moth, or 'Tomato Worm'
(*Protoparce celeus*, Hbn.).

The large caterpillar of this moth, known as the Tomato Sphinx, is frequently found in some numbers upon tomato vines, but its work is so conspicuous and the

tomato makes such rapid growth that its injuries are very seldom important in Canada. However, the caterpillar feeds on many other plants belonging to the Nightshade Family, such as the potato and tobacco. It is frequently the cause of considerable loss in the large tobacco fields in the county of Essex, where it is generally spoken of as the Tobacco Worm. This name, however, belongs properly to an allied species, *Protoparce carolina,* Linn., which occurs very rarely in Canada. The potato, however, must be considered an exceptional food plant and the insect is not likely to become a regular pest of that crop.

The Potato-stalk Weevil
(*Trichobaris trinotata,* Say), Fig. 38.

Attack.—About the middle of August several whitish legless grubs with brown heads boring inside the stems of potatoes. These cause the leaves to turn yellow and the stems to die prematurely. When full-grown, the grubs form white cocoons of fibres gnawed from the stem, usually low down in the stems. Inside these the beetles become mature in August and September, but they remain in the cocoons and do not emerge until the following spring.

The Potato Stalk Weevil has never been a serious enemy to potato growers in Canada, but might at any time become one.

Remedy.—The remedy is simple. As the perfect beetles pass the winter in their cocoons inside the stems of the plants they have attacked during the summer, if all of these are burnt in autumn instead of, as is too frequently the case, being left in heaps to rot in the fields, this insect can be easily controlled. The practice of promptly destroying with fire all haulms, tops, vines, &c., of such crops as have been taken in, cannot be too strongly advocated. Not only is untidy or objectionable litter thus removed and turned into useful fertilizing elements, but many injurious insects and fungous diseases are done away with, which would endanger the crop of the following year.

The Red-headed Flea-beetle
(*Systena frontalis,* Fab.), Fig. 39.

Attack.—Large black shining flea-beetles, one-fourth of an inch long, with a reddish blotch between the eyes. These sometimes occur in large numbers on potatoes and many other different plants, particularly clover, to which they are sometimes a serious pest. On the slightest disturbance they hop actively from the leaves which they are attacking.

The injuries to potatoes are sometimes rather severe and, when this is the case, demand attention.

Remedy.—Spraying potatoes with the Poisoned Bordeaux mixture (Remedy 7) is the best treatment. Other plants, as grape vines and many garden flowers, may be dusted with Paris green and lime, or, when convenient, sprayed with the Poisoned Bordeaux mixture.

The Turnip and Cabbage Aphis
(*Aphis brassicæ,* L.), Fig. 42.

Attack.—Clusters of gray plant-lice situated all round the bases of the stems and beneath the leaves of Swede turnips and all kinds of cabbages, from which they suck the sap, causing them to become withered and stunted and, in serious outbreaks, destroying whole crops. As a rule, these plant-lice are not noticed until the end of the

season; but in dry autumns, or on high land, they increase with incredible rapidity and become one of the most destructive enemies of the turnip grower. The eggs are laid late in autumn upon the leaves and stems of the plants.

The Turnip and Cabbage Aphis is very widespread, occurring in all parts of the Dominion. In British Columbia it is frequently very destructive to early cabbages and cauliflowers; but in eastern Canada the most important injury is to Swede turnips in fields at the time that they are forming their roots.

Remedies.—When cabbages in gardens are attacked, the colonies of plant-lice should be destroyed by spraying with kerosene emulsion (Remedy 2), or whale-oil soap (Remedy 5), on their first appearance. In turnip fields the injury is always in autumn, and the colonies of plant-lice should always be looked for when the turnips are being hoed and thinned. At this time good work may be done by simply hoeing out the infested plants and, having pulled some earth over them with the hoe, pressing it down with the foot. When the plant-lice are too numerous for this simple treatment, the infested plants, which at this time are generally in restricted areas, should be promptly sprayed with a knapsack sprayer, using kerosene emulsion (Remedy 2), or whale-oil soap, one pound in six gallons of water. As the eggs are laid late in autumn on the leaves of turnips and cabbages, remnants of these crops should always be ploughed down as soon as the crop is got in. Infested cabbages may be dipped in kerosene emulsion before storing for the winter.

The Turnip Flea-beetle or 'Turnip Fly'
(*Phyllotreta vittata,* Fab.), Fig. 40.

Attack.—Small active shining black beetles, ⅛th of an inch long, with yellowish marks on the wings, which eat the seed leaves of turnips and other cruciferous plants directly they appear above the ground. When disturbed they hop to some distance.

The injury by the Turnip Flea-beetle in hot, dry Junes is well known by farmers in every part of Canada. The larvæ have been found at Ottawa, feeding in the leaves of Curled Cress, a plant belonging to the same family as the turnip, but it is certain that this stage in the American insect is generally passed on the roots. As soon as young turnips appear above the ground the beetles swarm on them and destroy the seed leaves, which are so important to the young plants, frequently destroying whole crops and making it necessary to resow large areas.

Remedies.—(1) Paris green and land plaster, one pound of the former to twenty of the latter, dusted along the rows of young turnips, if possible when they are covered with dew, is an effective remedy against this troublesome insect. The land plaster acts as a stimulant to the plants and pushes on growth. As soon as the rough, true leaves are formed, the plants are, as a rule, able to make more growth than the beetles can destroy.

(2.) Late sowing. Careful observation has shown us that for central Ontario, the third week in June is the most satisfactory time for sowing turnips to avoid injury by flea-beetles. By that time the perfect insects of the first brood have, as a rule, disappeared, and the young plants grow rapidly and produce as good crops as when sown two and three weeks earlier.

The Red Turnip Beetle
(*Entomoscelis adonidis,* Fab.), Fig. 41.

Attack.—A showy scarlet beetle, with three black stripes down its back, a black patch on the collar, and black legs; two-thirds the size of the Colorado Potato Beetle, but narrower in outline, eating the leaves, both as larva and perfect beetle, of turnips, radishes, cabbages and all other plants of the Mustard family, or Cruciferæ.

The Red Turnip Beetle is every year abundant throughout the prairie provinces; but there are so many wild weeds of the Mustard family all through the West, that these plants have prevented the Red Turnip Beetle congregating upon cultivated crops to any serious degree. In certain localities noticeable injury has been done, and it is possible that at some future time this insect might become a serious enemy of the farmer. Although its specific name was given in reference to its feeding upon a member of the Ranunculus family, *Adonis autumnalis,* the Red Turnip Beetle has not been recorded in Canada as feeding upon any plant of other orders than the Cruciferæ. The bright red eggs are laid beneath clods of earth, large numbers joined together in loose masses. Although such a method of passing the winter is very rare among the Chrysomelidæ, to which this insect belongs, it would appear as if this were the usual habit in Canada. The perfect beetles appear during July and August and continue in the fields as late as October and November.

The larvæ are nocturnal in habit, and, although they also injure crops, most of the observed damage is done by the perfect beetles. The larvæ are slug-shaped and black in colour. When mature they are half an inch long. The pupa is formed in the ground about an inch or so beneath the surface.

Remedies.—Spraying with Paris green and other arsenites (Remedy 1), when the nature of the affected crops will allow of that practice, is the best remedy. As, however, the beetles occur very late in the season, it might be necessary to substitute dusting with insect powder or hellebore, should the beetles become abundant on crops of cabbages. Certain wild members of the Mustard family such as the Gray Tansy Mustard and the Prairie Wallflowers, seem to be particularly attractive to this insect, and might be used as decoy plants, upon which the beetles could be poisoned at short intervals.

The Carrot Rust-fly
(*Psila rosæ*, Fab.), Fig. 43.

Attack.—Early in the season the leaves of young carrots turn reddish, and the roots will be found to be blotched with rusty patches, particularly towards the tip. These carrots, when stored for winter use, although sometimes not showing much injury on the outside, may be found to be perforated in every direction by dirty brown burrows, in which are many semi-transparent yellowish maggots about ¼ of an inch long. These maggots are blunt at the tail end, but taper toward the head, where there is a black-hooked tip, forked at the base, by which the maggot makes its way through the roots. The puparium is reddish brown, and the maggots, as a rule, leave the carrots before assuming this form. The perfect fly is a quarter of an inch long, bright, shiny green-black, with yellow legs and red eyes. There are at least two broods in a season.

Carrots in the Maritime Provinces, and to a less extent and at wide intervals, through Quebec and Ontario, are often seriously injured by the larvæ of this European insect. In the Maritime Provinces it is a regularly occurring pest of the market gardener, and much loss every year is due to its ravages. To a less degree celery and parsnips are also sometimes attacked by this insect, but I have never seen in Canada more than an accidental occurrence on these crops

Remedies.—(1.) When young carrots are large enough to thin out, this should be done if possible late in the day, and the rows at once sprayed with kerosene emulsion (Remedy 2), one part of the ordinary emulsion to nine of water; or the rows may be dusted with sand, land plaster, or ashes, with which coal oil has been mixed at the rate of half a pint to an ordinary three-gallon patent pail of the diluent. One application a week should be made through June and into July, particularly after the rows have been thinned or hoed up. (2.) Late sowing has been advantageous in many instances,

and, as carrots for the table may be sown very late in the year and give good crops, it is advisable to make two or three sowings, a week or ten days apart, some of which will escape injury. (3.) The common-sense practice of not sowing carrots in the same spot as they were planted the previous year, will recommend itself to all growers. (4.) The destruction of the maggots from stored carrots. Where carrots are stored in sand for winter use, the larvæ leave the roots and pupate in this soil. Care must be taken, when cleaning out the bins in spring, to destroy these puparia either by burying the sand in a deep hole or by throwing it into a pond or into a barnyard, where it will be trampled by stock.

The Asparagus Beetles

(*Crioceris asparagi*, L., and *C. 12-punctata*, L.), Figs. 44, 45, 46.

Attack.—The Common Asparagus Beetle. Slender black beetles about ¼ of an inch in length, conspicuously marked with six white blotches on the back and a red border to the neck and elytra, or wing-cases; appearing in the early spring and eating into the asparagus shoots, upon which they lay their greenish black eggs. The grubs which hatch from these eggs are dark olive and slug-like. These also attack the shoots. The Twelve-spotted Asparagus Beetle. Occurring sometimes with the above, are beetles of about the same size, but slightly broader and of a uniform reddish orange colour, with twelve black spots upon the wing-cases. The grubs, somewhat similar to those of the Common Asparagus Beetle, but of a dirty yellowish colour, feed inside the berries of asparagus.

The two above-named species of beetles are now a regularly occurring trouble of asparagus growers in south-western Ontario; both species seem to occur together and to be equally abundant. Their first appearance was in 1898, and the spread in Canada has fortunately been far less extensive than it was at first feared it might be. There are two broods in the season, the first beetles attacking the young shoots and laying their eggs upon them. The larvæ are found on the foliage during the summer. The beetles pass the winter fully developed.

Remedies.—(1.) Dusting with lime. The most effective remedy is probably the destruction of the larvæ by dusting the plants systematically every three or four days with fresh air-slaked lime, which adheres to their slimy bodies and kills all those with which it comes in contact. (2.) Poisoning. Active poisons, as a mixture of Paris green and flour, or, better, Paris green mixed with the lime mentioned above, and dusted through the plants, will kill not only by contact with the larvæ, but will destroy both them and the perfect beetles which eat the poisoned foliage. (4.) Beating. Beetles and larvæ may be beaten from the plants into nets or broad pans containing water and coal oil. Nets made specially for the purpose are most convenient. The larvæ may also be brushed off the plants with a stick, and, if this is done in the middle of a hot day, it is claimed that few will be able to get back again on to the plants. (5.) Poultry Chickens and ducks, when available, are very useful in eating the beetles when they first appear in spring.

The Spinach Carrion Beetle

(*Silpha bituberosa*, Lec.), Fig. 48.

Attack.—Shiny black, very active flattened grubs, three-quarters of an inch long, shaped like sow-bugs or wood-lice, which devour the leaves of plants belonging to the Spinach and Gourd families.

The Spinach Carrion Beetle belongs to a family, most of the members of which are scavengers, but there are two species at any rate, the present one and the Beet Carrion Beetle (*S. opaca* L.), which in the West have caused injury to grow-

ing crops of pumpkins, squashes, spinach and beet. The injury is done by the larvæ, which come out at night and destroy the foliage of these plants. The beetles of both species are very similar, are dull black, the body flat and thin, about three-quarters of an inch in length, with straight ridges on the wing covers and a little raised knob towards the end of each of these. The beetles pass the winter hidden away beneath clods, refuse, &c., and lay their eggs in June. The young larvæ appear in about a week and grow rapidly, maturing within three or four weeks.

Remedies.—The only remedies which can be suggested, are the dusting of the young plants in June when the grubs appear, with a dry Paris green mixture, or spraying them with Poisoned Bordeaux mixture (Remedy 7). In the case of spinach, which could not be poisoned in this way, it might be possible to protect it during the season when the eggs are laid by covering the plants with cheese cloth frames, as recommended for Root Maggots (see page 35). The native weed of the West, the Spear-leaved Goosefoot (*Monolepis chenopodioides*) which is stated to be the favourite food plant of these insects, might also be sown close to the spinach to draw off attack.

The Squash Bug
(*Anasa tristis*, DeG.), Fig. 49.

Attack.—Numbers of large, ill-smelling, dark brown bugs, paler beneath, ⅝ of an inch long, clustering around squash vines about the end of June and sucking the sap. The eggs are laid in clusters beneath the leaves, and the young are soon found with the full grown bugs.

This destructive enemy of the market gardener attacks all plants of the Gourd family. It is a serious pest in western Ontario, but is seldom troublesome as far east as Ottawa. The insect is a true bug and has the characteristic disagreeable odour of most insects of that family. It passes the winter in the perfect form beneath loose bark of trees, under rubbish in out-buildings, &c. As soon as squashes, &c., appear above the ground in spring, the bugs fly to the fields and attack the young plants. Their injuries at that time of the year are particularly severe. Eggs are laid at once and the young bugs of the first generation come to full growth in July. There are two broods in the season, but bugs of all sizes may be found upon the vines after midsummer.

Remedies.—(1.) Hand-picking of the old bugs early in the season is claimed to be the most practical remedy. This should be done early in the morning, during the cooler hours of the day, when the bugs are sluggish. The conspicuous egg clusters should also be crushed when seen.

(2.) Traps. If shingles or short pieces of board are placed among the plants, the bugs will hide beneath them at night and can be destroyed before they become active and leave these retreats the next morning.

(3.) The young bugs can be destroyed by spraying with kerosene emulsion (Remedy 2), or whale-oil soap (Remedy 5).

(4.) In a season when the bugs have been abundant, all vines should be burnt as soon as the crop has been gathered. In this way, many of the insects in all stages of development will be destroyed.

(5.) Tray Crops. A few hills of the ordinary squash may be planted among melons, cucumbers, &c., so that they appear above the ground about a week before the crop. The squashes being more attractive, the bugs collect upon them, where they can be easily destroyed.

The Striped Cucumber Beetle
(*Diabrotica vittata*, Fab.), Fig. 50.

Attack.—Yellow beetles striped with black, two-fifths of an inch in length and half as wide as long. These beetles pass the winter in the perfect state, and, directly

young seedlings of cucumbers or squashes of all kinds appear above the ground, cluster around and destroy them. Later in the year the same beetles attack the plants, devouring the leaves from beneath and also other parts of the plant. The larvæ, which are slender worm-like creatures, white, with dark heads, live in the ground about the roots, boring into them and sometimes working their way up above the ground inside the stems.

The Striped Cucumber Beetle occurs all through Canada, east of the prairies, and is frequently very destructive to young plants in spring, and particularly to the flowers. There are two broods in Canada, the second of which is frequently much more abundant but less destructive than the first to cucurbitaceous plants such as squashes, cucumbers, &c. In addition to this class of plants, the beetles sometimes do considerable damage in crops of peas and beans, gnawing the green pods and rendering them unfit for the market.

Remedies.—Covers. Young plants may be protected from the beetles with a square of cheese cloth kept raised by two flexible sticks crossed at right angles, with the ends stuck into the ground. The cheese cloth can be kept in place by putting some earth on the edges. By the time the plants have grown so as to require the removal of the covering most of the first brood will have disappeared.

Poisons. Spraying the young vines with Poisoned Bordeaux mixture (Remedy 7), will protect cucurbits against the attacks of this beetle, and also of the Cucumber Flea-beetle. Paris green and land plaster, ashes, or lime (one pound of the poison in fifty of the diluent), if dusted over the plants at short intervals of a few days, will destroy a great many of the beetles, and drive others away. A similar remedy is to sprinkle through the plants land plaster thoroughly saturated with kerosene or turpentine, both of which are very distasteful to this insect. Dusting the plants around the roots with refuse tobacco dust, is highly recommended; but this material is difficult to obtain.

The Striped Cucumber Beetles are very active and fly freely from plant to plant, and, as these plants grow very rapidly, all poisons must be frequently renewed.

INDEX.

PAGE.

Anasa tristis.. 45
Aphis brassicæ.. 41
mali.. 18
rumicis.. 27
Apparatus, spraying.. 6
Apple Aphis.. 17
Army-worm.. 30
Army-worm, Black.. 32
Arsenate of lead.. 9
Arsenite of lime with soda.. 9
Arsenites.. 8
Arsenoid, Green.. 10
Asparagus Beetle, Common.. 44
Asparagus Beetle, Twelve-spotted.. 44
Asparagus Beetles.. 44
Autographa brassicæ.. 37
precationis.. 37
Banding or wrapping for Cutworms.. 33
Bean Aphis.. 27
Bean Weevil.. 26
Bean Weevil, European.. 27
Beet Carrion Beetle.. 44
Binder twine eaten by locusts.. 22
Bisulphide of carbon for Pea Weevil. 23
Blister Beetle, Black.. 40
Blister Beetle, Spotted.. 40
Blister Beetles.. 39
Blister Beetles, Gray.. 40
Bordeaux mixture, poisoned.. 12
Bruchus obtectus.. 27
pisorum.. 23
rufimanus.. 27
Cabbage Aphis.. 41
Cabbage Butterfly, Small White.. 36
Cabbage-looper, Eyed.. 37
Cabbage Maggot.. 34
Cabbage Plusia.. 37
Cabbage Worm, Purple-backed.. 38
Cabbage Worms.. 35
Camnulla pellucida.. 21
Carbolic acid.. 12
Carbolized plaster, sand, ashes or sawdust.. 12
Carrion Beetle, Beet.. 44
Carrion Beetle, Spinach.. 44
Carrot Rust-fly.. 43
Cecidomyia destructor.. 13
leguminicola.. 26
Cephus occidentalis.. 16
pygmæus.. 17
Cheese-cloth inclosures.. 35
Chorizagrotis agrestis.. 32
auxiliaris.. 32
introferens.. 32

PAGE.

Click-beetles, larvæ of.. 18
Clover Leaf Weevil.. 28
Clover Root-borer.. 29
Clover Weevil, Green.. 28
Clover-seed Caterpillar.. 29
Clover-seed Midge.. 28
Coal oil for Pea Weevil.. 24
Colorado Potato Beetle.. 39
Corn Worm.. 20
Corn-seed Maggot.. 34
Criddle mixture for locusts.. 22
Cottony Grass Scale.. 30
Crioceris asparagi.. 44
duodecimpunctata.. 44
Cucumber Beetle, Striped.. 45
Cucumber Flea-beetle.. 40
Cutworm, Clover.. 32
Dark-sided.. 32
Glassy.. 20
Red-backed.. 20, 32
Spotted.. 32
Variegated.. 32
White.. 32
Yellow-headed.. 20
Cutworms in grain.. 20
on roots and vegetables.. 31
Dargida procinctus.. 32
Diabrotica vittata.. 45
Diamond-back Moth.. 36
Diplosis tritici.. 16
Doryphora decemlineata.. 39
Elateridæ.. 18
Entomoscelis adonidis.. 42
Epicauta cinerea.. 40
maculata.. 40
pennsylvanica.. 40
Epitrix cucumeris.. 40
Eriopeltis festucæ.. 30
Evergestis straminalis.. 38
Flea-beetle, Red-headed.. 41
Flea-beetle, Turnip.. 42
Four-lined Leaf-bug.. 40
Frit Fly, American.. 15
Fumigation with bisulphide of carbon. 24
Fungous disease of locusts.. 22
Grain Aphis.. 17
Grapholitha interstinctana.. 29
Grasshoppers.. 21
Hadena arctica.. 20
devastatrix.. 20
Hawk-moth, Five-spotted.. 40
Heliophila unipuncta.. 30
Heliothis armiger.. 20
Hellebore, white.. 10

PAGE.

Hessian Fly.. 13
Holding over seed pease for Pea Weevil.. 24
Hop Aphis.. 17
Hopper dozers.. 21
Hylastinus obscurus.. 29
Hylesinus trifolii.. 29
Insect powder.. 11
Insects, Biting and Sucking.. 5
Insects, lives of.. 5
Isosoma sp.. 14
Joint-worms.. 14
June Bugs.. 19
Kerosene emulsions.. 10
Lachnosterna fusca.. 18
Leaf-bug, Four-lined.. 40
Leptinotarsa decemlineata.. 39
Leucania unipuncta.. 30
Locust, Lesser Migratory.. 21
Packard's.. 21
Pellucid.. 21
Red-legged.. 21
Rocky Mountain.. 21
Locusts.. 21
Mamestra picta.. 37
trifolii.. 32
May Beetles.. 19
Melanoplus affinis.. 21
atlanis.. 21
bivittatus.. 21
femur-rubrum.. 21
packardii.. 21
spretus.. 21
Meromyza americana.. 14
Netarophora destructor.. 27
granaria.. 17
Noctua c-nigrum.. 32
fennica.. 32
Nozzles, spraying.. 7
Onion Maggot.. 34
Oscinis carbonaria.. 15
soror.. 15
variabilis.. 15
Paragrotis messoria.. 32
ochrogaster.. 20, 32
perexcellens.. 32
scandens.. 32
Paris green.. 8
used in Bordeaux mixture.. 12
used in Criddle mixture.. 22
used in poisoned traps.. 32
used in poisoned bran-mash.. 33
danger from use of.. 33
Pea Aphis, Destructive.. 27
'Pea Bug'.. 23

PAGE.

Pea Moth.. 22
Pea Weevil.. 23
Pease, 'wormy'.. 23
Peridroma saucia.. 32
Phorbia brassicæ.. 34
ceparum.. 34
fusciceps.. 34
Phyllotreta vittata.. 42
Phytonomus nigrirostris.. 29
punctatus.. 28
Pionea straminalis.. 38
Plusia brassicæ.. 37
Plutella cruciferarum.. 36
maculipennis.. 36
Pœcilocapsus lineatus.. 40
Pontia rapæ.. 36
Potato Beetle, Colorado.. 38
Potato Flea-beetle.. 40
Potato Stalk Weevil.. 41
Protoparce carolina.. 41
celeus.. 40
Psila rosæ.. 43
Pumps, spraying.. 7
Pyrethrum.. 11
Radish Maggot.. 34
Red-headed Flea-beetle.. 41
Remedies.. 7
Root Maggots.. 34
Scalding seed pease for Pea Weevil.. 24
Semasia nigricana.. 22
Silpha bituberosa.. 44
opaca.. 44
Soap washes.. 11
Spinach Carrion Beetle.. 44
Spraying, meaning of the word.. 7
Spraying apparatus.. 6
Squash Bug.. 45
Systena frontalis.. 41
Tarred paper disks for Root Maggots.. 34
Tobacco Worm.. 40
Tomato Sphinx.. 40
'Tomato Worm'.. 40
Trichobaris trinotata.. 41
Turnip Aphis.. 41
Turnip Beetle, Red.. 42
Turnip Flea-beetle.. 42
'Turnip Fly'.. 42
Whale-oil soap.. 11
Wheat Midge.. 16
Wheat-stem Maggot, Greater.. 14
Wheat-stem Maggot, Lesser.. 15
Wheat-stem Sawfly, Western.. 16
White Grubs.. 19
Wireworms.. 18
Zebra Caterpillar.. 37

PLATE I.

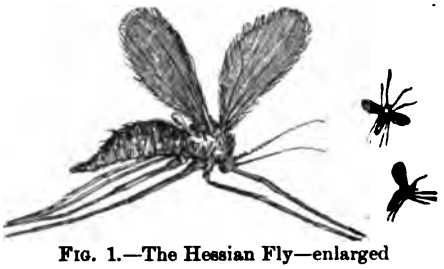


FIG. 1.—The Hessian Fly—enlarged and natural size.

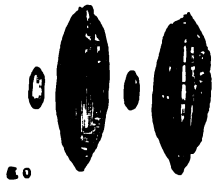


FIG. 2.—Hessian Fly: puparia—natural size and enlarged.

FIG. 3.—Hessian Fly: puparia on stem.

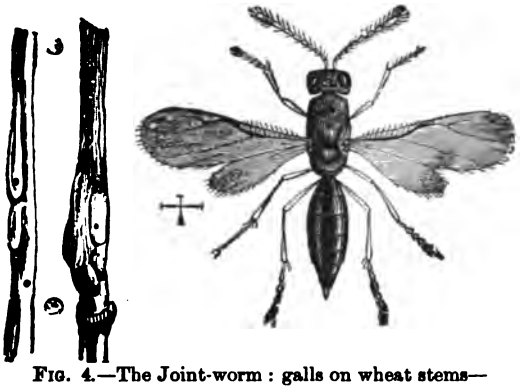


FIG. 4.—The Joint-worm: galls on wheat stems—natural size; fly—enlarged.

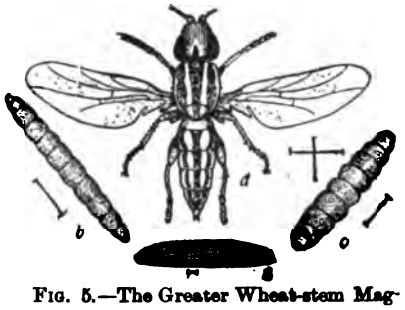


FIG. 5.—The Greater Wheat-stem Maggot: *a*, egg; *b*, maggot; *c*, pupa; *d*, fly—all enlarged.
(Prof. H. Garman.)

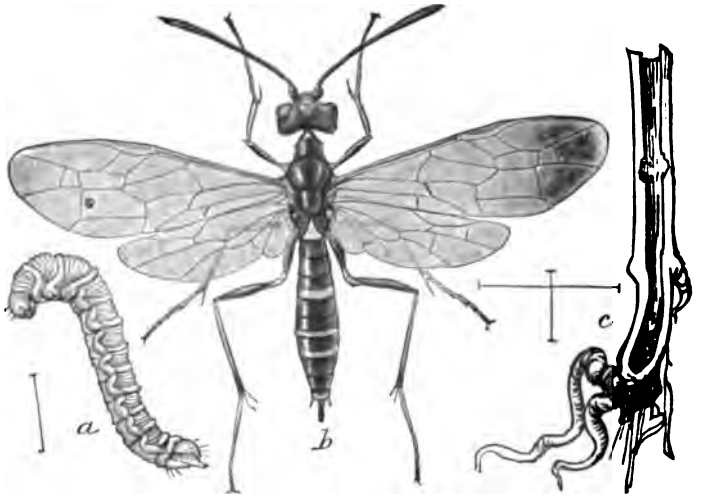


FIG. 6.—The Western Wheat-stem Sawfly: *a*, larva; *b*, female sawfly; *c*, grass stem showing work—*a*, *b*, much enlarged.
(Riley & Marlatt, Insect Life, IV, Division of Entomology, U.S. Dept. of Agr.)

PLATE II.

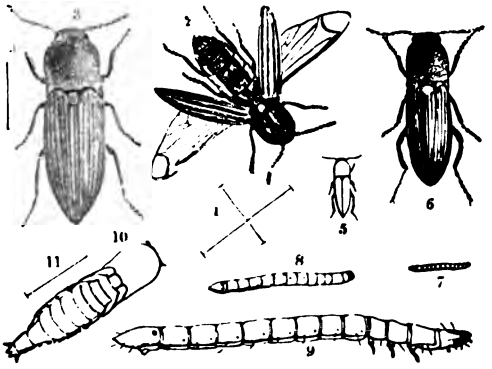


FIG. 7.—Wireworms (7, 8, 9); pupa (10)—enlarged; click-beetles (5—natural size; 2, 3, 6—enlarged). *(Curtis.)*

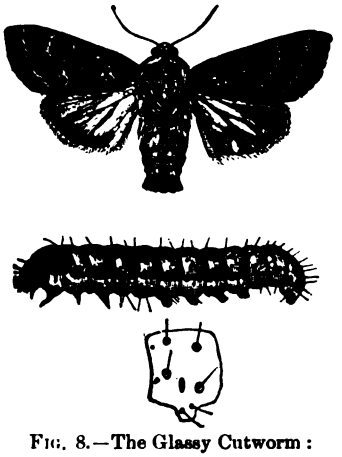


FIG. 8.—The Glassy Cutworm: moth and caterpillar.

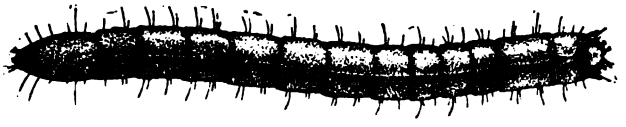


FIG. 9.—Corn Wireworm—enlarged 4 diameters. *(Forbes, Bull. 44, Ill. Agr. Exp. Station.)*

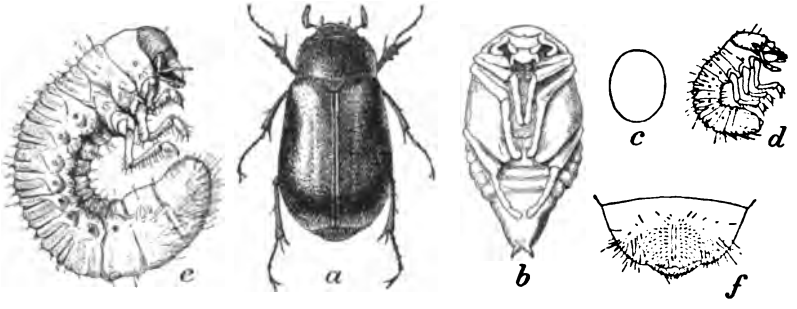


FIG. 10.—May Beetle: *a*, beetle; *b*, pupa; *c*, larva (White Grub)—slightly enlarged *(Chittenden, Bull. 19, n.s., Div. of Ent., U. S. Dept. of Agr.)*

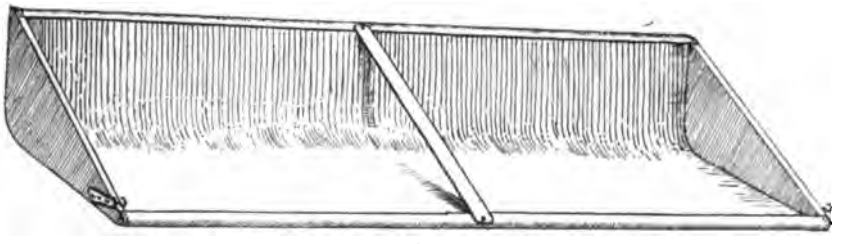


FIG. 11.—A Hopperdozer.

PLATE III.

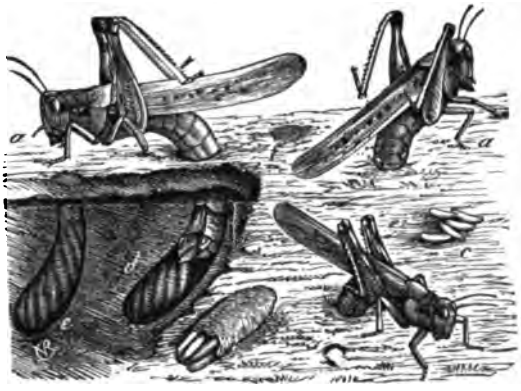


FIG. 12.—Rocky Mountain Locusts laying eggs.

FIG. 13.—The Common Red-legged Locust.

FIG. 14.—The Two-striped Locust.

(Fig. 12: Riley.—Figs. 13, 14: Chittenden, Bull. 43, n.s., Div. of Ent., U.S. Dept. of Agr.)

FIG. 15.—The Pea Moth: caterpillar and moth—2 and 4 enlarged.
(Curtis.)

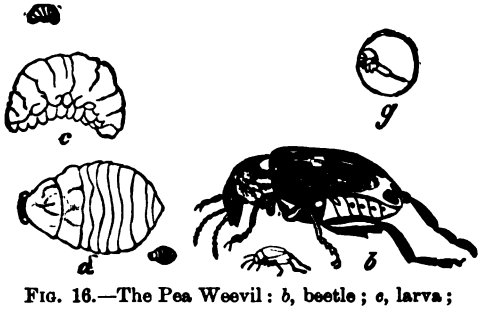


FIG. 16.—The Pea Weevil: *b*, beetle; *c*, larva; *d*, pupa—enlarged and natural size.
(Curtis.)

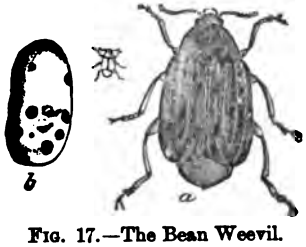


FIG. 17.—The Bean Weevil.

FIG. 18.—The European Bean Weevil.

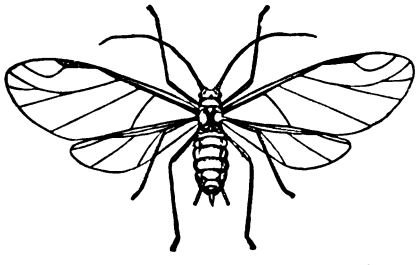


FIG. 19.—The Destructive Pea Aphis: winged viviparous female—enlarged 6 times.

Fig. 20.—The Clover Root-borer.

FIG. 21.—Army-worm.

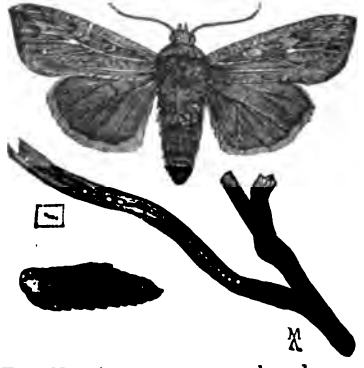


FIG. 22.—Army-worm: moth and pupa.

FIG. 23.—The Cotonny Grass Scale: egg-sacks on grass.

(Figs. 24, 25: Chittenden. Bull. 43, n.s., Div. of Ent., U.S. Dep. of Agr.—Fig. 26: Chittenden. Circ. 60, Div. of Ent., U.S. Dep. of Agr.)

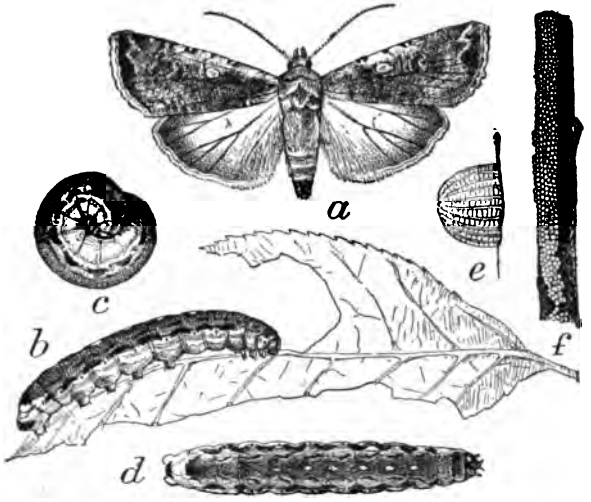


FIG. 24.—The Variegated Cutworm: *a*, moth; *b*, *c*, *d*, caterpillars; *e*, egg—enlarged; *f*, egg mass on twig.

FIG. 25.—The Greasy Cutworm.

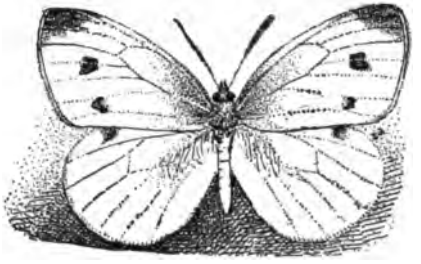


FIG. 26.—The Small White Cabbage Butterfly.

PLATE V.

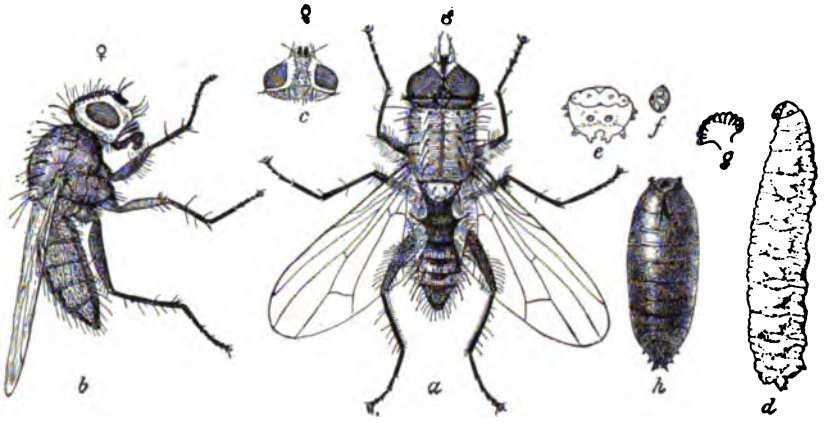


FIG 27.—The Seed-corn Maggot: *a*, *b*, flies; *d*, maggot; *h*, puparium—all very much enlarged.

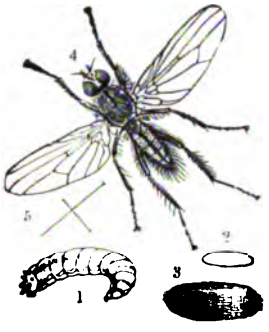


FIG. 28.—The Cabbage Maggot: 1, maggot; 2, 3, pupa case; 4, fly—1, 3 and 4 enlarged.

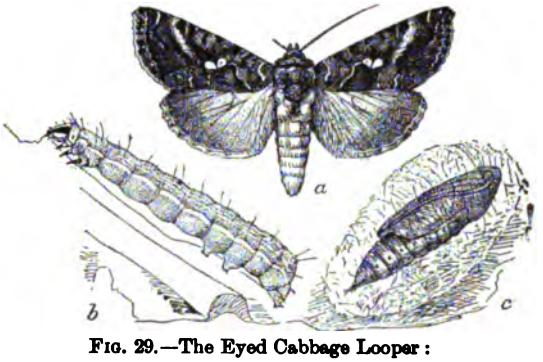


FIG. 29.—The Eyed Cabbage Looper: *a*, moth: *b*, caterpillar; *c*, pupa in cocoon—all somewhat enlarged.

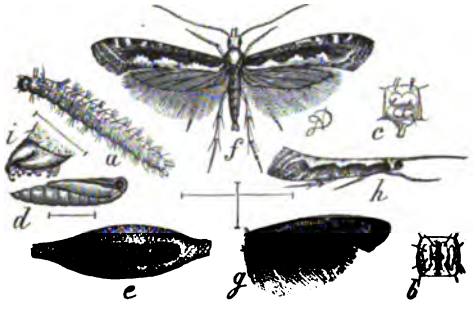


FIG. 30.—The Diamond-back Moth: *a*, caterpillar; *d*, pupa; *e*, cocoon; *f*, moth—enlarged.

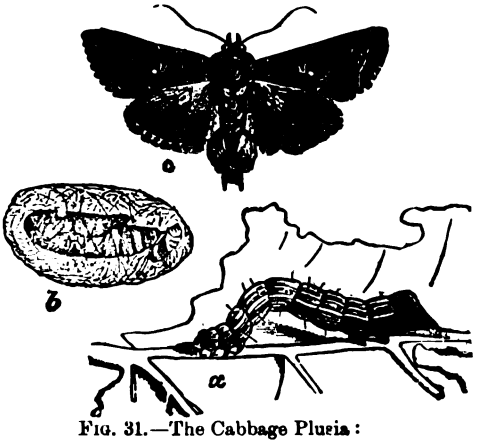


FIG. 31.—The Cabbage Plusia: *a*, caterpillar; *b*, pupa in cocoon; *c*, moth.

(Figs. 27, 29, 31: Chittenden, Bull. 33, n.s., Div. of Ent., U.S., Dep. of Agr.—Fig. 30: Rep. 1884, U.S. Dep. of Agr.)

PLATE VI.

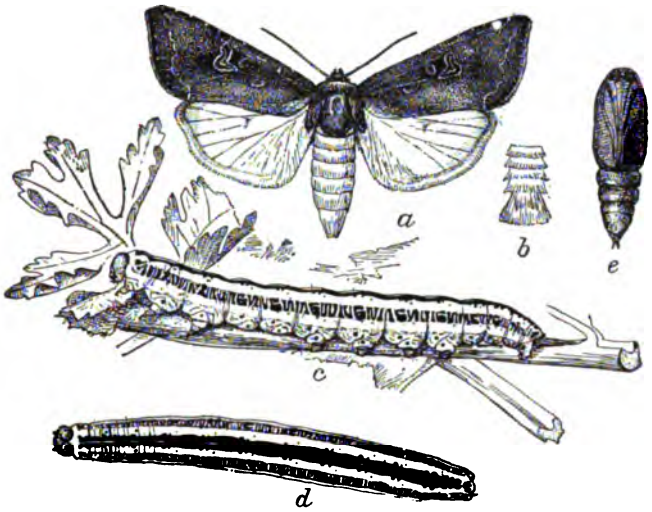


FIG. 32.—The Zebra Caterpillar : *a*, moth ; *c*, pupa ; *d*, caterpillar.

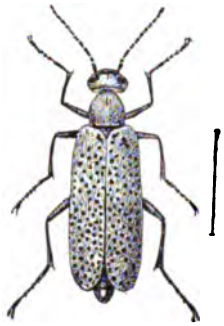


FIG. 33.—The Spotted Blister Beetle—enlarged.

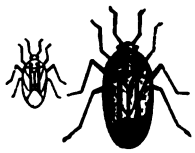


FIG. 34.—The Four-lined Leaf-bug.

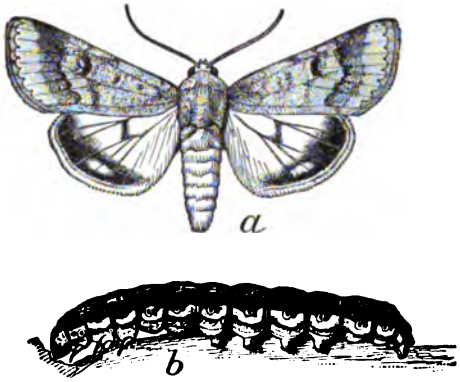


FIG. 35.—The Corn Worm : moth and caterpillar.

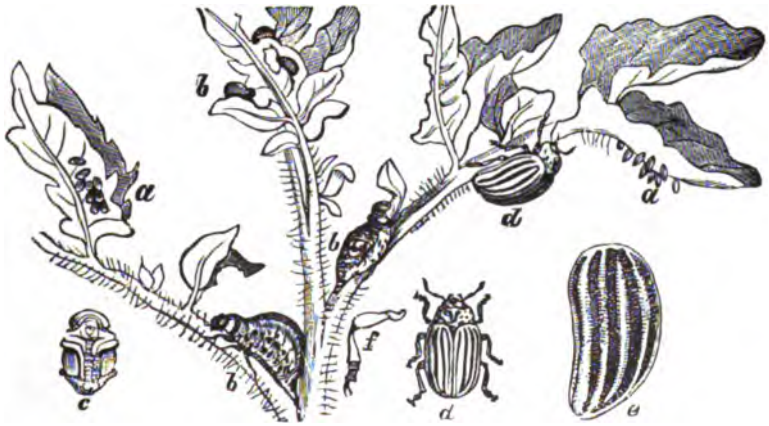


FIG. 36.—The Colorado Potato Beetle : *a*, eggs . *b*, larva ; *c*, pupa ; *d*, beetle.

(Figs. 32, 33 : Chittenden, Bull. 43, n.s., Div. of Ent., U.S. Dept. of Agr.—Fig. 35 : Howard, Farmers' Bull. 120, U.S. Dept. of Agr.)

PLATE VII.

FIG. 37.—The Cucumber and Potato Flea-beetle.

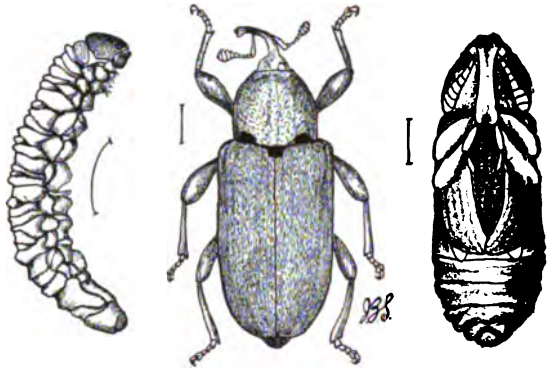


FIG. 38.—The Potato Stalk Weevil: larva, beetle and pupa—enlarged.

FIG. 39.—The Red-headed Flea-beetle—enlarged 8 times.

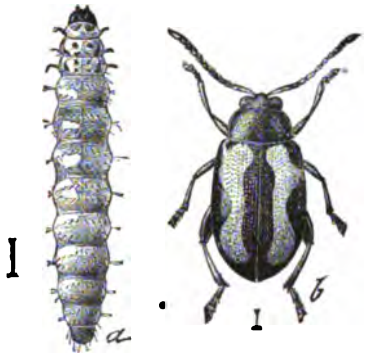


FIG. 40.—The Turnip Flea-beetle—enlarged 8 times.

FIG. 41.—The Red Turnip Beetle—enlarged 6 times.

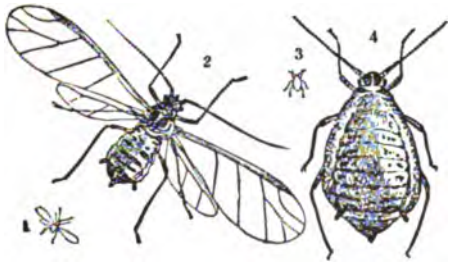


FIG. 42.—The Cabbage Aphis: 1 and 2, male; and 4, wingless female—2 and 4 enlarged,

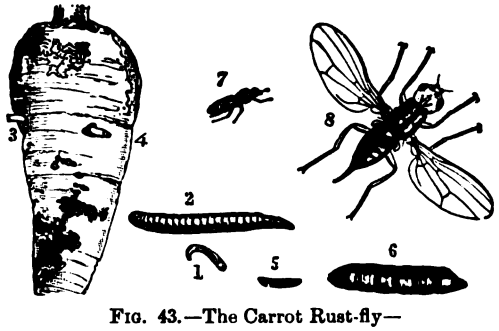


FIG. 43.—The Carrot Rust-fly—1, 5, 7, natural size; 2, 6, 8 enlarg

FIG. 37: *Chittenden, Bull. 19, n.s.. Div. of Ent., U.S. Dept. of Agr.—Fig. 38: J. B. Smith, Economic Entomology.—Figs. 39, 40, 41: Chittenden, Bull. 33, n.s., Div. of Ent., U.S. Dept of Agr.—Fig. 43: Curtis.*)

FIG. 44.—The Common Asparagus Beetle—enlarged 8 times.

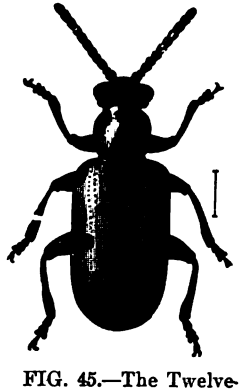


FIG. 45.—The Twelve-spotted Asparagus Beetle—enlarg

FIG 46.—The Common Asparagus Beetle: different stages on asparagus spray.

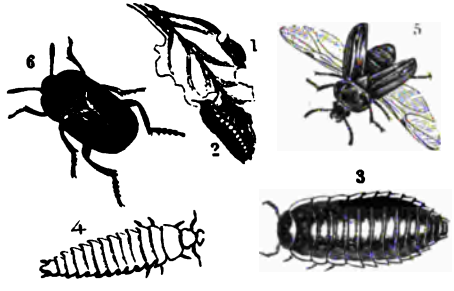


FIG. 47.—The Beet Carrion Beetle (5, 6); larva (1, 2, 3, 4).

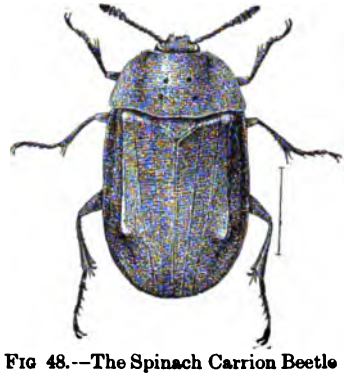


FIG 48.—The Spinach Carrion Beetle—enlarged 4 times.

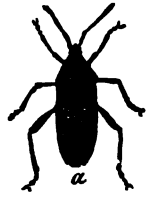


FIG. 49.
The Squash Bug.

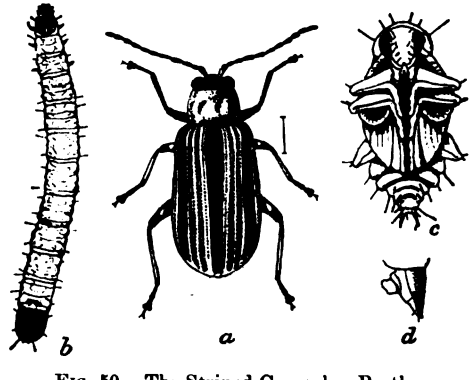


FIG. 50.—The Striped Cucumber Beetle: *a*, beetle; *b*, larva; *c*, pupa—enlarged 8 times.

(Figs. 44, 45, 46: Chittenden, Year Book, 1896, U.S. Dep. of Agr.—Fig. 47: Curtis.—Fig. 48: Chittenden, Bull 43, n.s., Div. of Ent., U.S. Dep. of Agr.—Fig. 50: Chittenden, Circ. 31, 2nd s., Div. of Ent., U.S. Dep. of Agr.)

133
.E22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

RESULTS OBTAINED IN 1905

FROM

TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS

AND

POTATOES

BY

WILLIAM SAUNDERS, C.M.G., LL.D
Director of Experimental Farms

AND

CHAS. E. SAUNDERS, Ph. D.
Cerealist.

BULLETIN No. 53

NOVEMBER, 1905.

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER,
MINISTER OF AGRICULTURE

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

RESULTS OBTAINED IN 1905

FROM

TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS

AND

POTATOES

BY

WILLIAM SAUNDERS, C.M.G., LL.D
Director of Experimental Farms

AND

CHAS. E. SAUNDERS, Ph. D.
Cerealist.

BULLETIN No. 53

NOVEMBER, 1905.

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER,
MINISTER OF AGRICULTURE

TABLE OF CONTENTS

	Page.
Results of Experiments with Spring Wheat	6
" " " Macaroni Wheat	9
" " " Emmer and Spelt	11
" " " Oats	13
" " " Six-rowed Barley	17
" " " Two-rowed Barley	20
" " " Pease	22
" " " Indian Corn	25
" " " Turnips	29
" " " Mangels	32
" " " Carrots	36
" " " Sugar Beets	38
" " " Potatoes	41
Summary	47

To the Honourable
The Minister of Agriculture.

SIR,—I beg to submit herewith, for your approval Bulletin No. 53 of the Experimental Farm series, which has been prepared by the Cerealist, Dr. C. E. Saunders and myself. There are presented in this publication the results of a large number of experiments, which have been conducted at all the experimental farms in your Department during the season of 1905, with spring wheat, macaroni wheat, emmer and spelt, oats, barley, pease, Indian corn, turnips, mangels, carrots, sugar beets and potatoes, in plots of uniform size, and with the crops grown under fairly uniform conditions. The average results are also given of the tests for the past five years of those varieties which have been long under trial.

These test plots are conducted with the object of gaining information as to the relative productiveness of the different sorts and their earliness in ripening. The returns show much variation in the weight of the crops grown and point to the importance of care in the choice of varieties of seed for sowing. It is hoped that these results giving the experience gained under some of the more important climatic variations found in the country, will prove useful to farmers in every part of Canada.

I have the honour to be,
Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, November 27, 1905.

RESULTS OBTAINED

FROM TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS AND POTATOES

By William Saunders, C.M.G., LL.D., F.R.S.C., F.L.S., &c.

Director of Experimental Farms

and Chas. E. Saunders, B.A., Ph.D., *Cerealist.*

During the past eleven years experiments have been conducted on uniform trial plots at each of the Dominion Experimental Farms for the purpose of gaining information as to the most productive and earliest ripening varieties of grain, fodder corn, field roots and potatoes. In arranging for these plots the same varieties have been sown at each of the farms, the seed being supplied at the outset from a common stock. In each case seed has been sown early, and, as a rule, all the different sorts of the same crop have been sown on the same day or at most within two or three days so as to give to all an even start. The land chosen each year for these plots has been as nearly uniform in character as could be found and before sowing has been brought into a good condition of tilth. In this bulletin which is the eleventh of the series, the results of the experiments are presented in the same form as that adopted last year, giving special prominence to the average yield of each variety for the past five years, as being the more trustworthy basis from which to draw conclusions, and relegating the figures obtained in the current year to a subordinate place.

The varieties are therefore placed in the tables in the order of their average yield for the last five years. Those which have only been grown for shorter periods are placed in a separate group. While a five-year period is undoubtedly rather short, it seems undesirable to lengthen it, since by so doing all recently introduced varieties would be kept too long from taking their place in the tables with the older sorts.

During 1905 the spring season at Nappan was cold and wet which delayed seeding, but the warm weather which followed was favourable for growth and good average yields of grain were obtained. Later in the year the weather was unusually dry which lessened the crop of roots. At Ottawa cereals of all sorts have yielded well, pease, Indian corn, field roots and potatoes have also for the most part given returns above the average. At Brandon the results of the harvest have been most gratifying, wheat, oats and barley have given very heavy yields and field roots and potatoes unusually large crops. At Indian Head the grain crops have also been remarkably heavy, while Indian corn, pease, field roots and potatoes have given excellent returns. At Agassiz, all sorts of grain have done well excepting wheat which has been severely injured by the wheat midge *Diplosis tritici* which destroyed the larger part of the crop. Indian corn, field roots and potatoes have all given crops above the average.

The following lists include only those varieties which are being grown on all the Dominion Experimental Farms.

It frequently happens that a variety of grain is grown for one or two years at the Central Farm before being sent out to be tested at the branch farms. In all such cases, in order to secure uniformity in the tables in this bulletin, the yields at the Central Farm are only recorded for those years in which the varieties were grown on all the farms.

In computing the averages for these tables the same five years have been used in each case, except in a few instances where the omission or failure of one of the plots made a blank in the records for that year. These instances are marked with a cross † and the true position in the tables of the varieties so marked is on this account to be regarded as somewhat uncertain.

* Cross-bred varieties produced on the Experimental Farms are marked with an asterisk.

SPRING WHEAT.

Twenty-six varieties of spring wheat (exclusive of the macaroni wheats) have been grown on the uniform test plots at all the Dominion Experimental Farms during the past season. The size of the plots was one-fortieth of an acre at Ottawa, Ont., Nappan, N. S. and Agassiz, B. C.; while at Brandon, Man., and Indian Head, Sask., the plots were each one-twentieth of an acre. The seed was sown at the rate of one and one-half bushels per acre. The dates of sowing were as follows:—At Ottawa, April 24; at Nappan, May 13; Brandon, April 10 to 12; Indian Head, April 6; and at Agassiz, April 18.

In Canada the bushel of wheat is 60 lbs.

SPRING WHEAT.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston *	35	13	116	32	40	15	Dawn *	32	25	116	31	4
2	Advance *	34	42	117	30	2	16	Percy *	32	15	116	28	12
3	Monarch	34	14	121	31	32	17	Chester *	32	15	117	29	36
4	White Fife	34	9	120	30	54	18	Pringle's Champlain	32	4	118	28	56
5	Red Fife	34	6	120	30	..	19	Minnesota No. 163	31	59	121	30	8
6	Wellman's Fife	33	38	121	32	26	20	Countess *	31	51	117	27	26
7	White Russian	33	34	120	27	..	21	Red Fern	31	36	119	25	8
8	Stanley *	33	32	117	31	20	22	Herisson Bearded	31	30	119	24	52
9	Huron *	33	25	117	30	6	23	Australian No. 9	30	52	119	30	14
10	Laurel *	33	24	121	32	8	24	Weldon *	30	49	119	23	58
11	Power's Fife—(Minn. 149)	32	54	121	28	46	25	Haynes' Blue Stem—(Minn. 169)	30	32	121	30	22
12	Clyde *	32	54	118	26	14	26	Early Riga *	29	56	111	23	36
13	Colorado	32	41	117	27	56							
14	McKendry's Fife — (Minn. 181)	32	31	121	31	18							

SPRING WHEAT—*Continued.*

The average crop of the twenty-six varieties of spring wheat tested on all the Experimental Farms in 1905 was 29 bushels 5 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston *	31	28	106	34	20	15	Laurel *	27	22	111	32	40
2	Herisson Bearded	30	24	109	29	20	16	Dawn *	27	8	106	34	20
3	Advance *	30	20	108	36	..	17	Minnesota 163	27	4	112	30	20
4	Pringle's Champlain	29	44	107	34	20	18	Colorado	26	16	107	31	..
5	Huron *	29	18	109	33	30	19	Countess *	26	12	105	29	..
6	McKendry's Fife — (Minn. 181)	29	12	111	33	..	20	Percy *	26	4	106	28	40
7	Red Fern	28	34	109	33	20	21	Weldon *	25	36	109	26	20
8	White Fife	28	26	112	27	20	22	Haynes' Blue Stem — (Minn. 169)	24	48	112	27	..
9	Red Fife	28	22	112	33	20	23	Power's Fife —(Minn. 149)	24	32	112	26	40
10	Clyde *	28	14	110	30	40	24	Stanley *	24	20	106	32	20
11	White Russian	27	50	114	32	20	25	Early Riga *	22	48	100	35	..
12	Monarch	27	38	113	31	40	26	Australian No. 9	21	42	107	32	20
13	Wellman's Fife	27	30	112	36	20							
14	Chester *	27	22	106	37	40							

The average crop of the twenty-six varieties of spring wheat tested on the Central Experimental Farm at Ottawa in 1905 was 31 bushels 53 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston *	33	44	112	34	..	16	McKendry's Fife (Minn. 181)	29	44	116	30	40
2	Advance *	33	24	112	28	..	17	Power's Fife (Minn. 149)	29	32	116	27	..
3	White Fife	33	24	116	27	40	18	Dawn *	29	28	113	25	20
4	Monarch	33	24	116	34	40	19	Red Fern	29	20	113	20	40
5	Red Fife	33	4	113	24	40	20	Huron *	28	52	113	18	..
6	Wellman's Fife	33	4	116	26	40	21	Weldon *	28	52	115	25	..
7	Clyde *	32	48	114	27	20	22	Herisson Bearded	27	52	114	13	20
8	Colorado	32	40	112	31	20	23	Australian No. 9	27	40	117	26	..
9	Laurel *	32	20	116	30	..	24	Percy *	27	40	114	20	..
10	White Russian	31	36	116	24	..	25	Minnesota No. 163	27	24	116	20	20
11	Pringle's Champlain	31	24	112	35	..	26	Haynes' Blue Stem (Minn. 169)	26	48	116	28	20
12	Early Riga *	31	..	109	14	..							
13	Stanley *	30	12	115	30	40							
14	Chester *	30	5	114	20	..							
15	Countess *	29	44	115	26	..							

The average crop of the twenty-six varieties of spring wheat tested on the Experimental Farm at Nappan in 1905 was 25 bushels 43 lbs. per acre.

SPRING WHEAT—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Advance*	36	8	119	46	40	15	Clyde*	31	32	121	34	20
2	White Fife	35	12	124	47	20	16	Percy*	31	30	118	43	20
3	Red Fife	34	48	124	45	20	17	Minnesota No. 163	30	52	123	43	40
4	Australian No. 9	34	24	122	41	..	18	Haynes' Blue Stem (Minn. 169)	30	44	124	44	40
5	Monarch	34	20	124	41	..	19	Herisson Bearded	30	28	120	41	..
6	Power's Fife (Minn. 149)	34	18	124	44	..	20	Pringle's Champlain	30	18	119	41	40
7	Dawn*	33	44	119	41	40	21	Colorado	29	56	120	36	40
8	Huron*	33	24	119	47	..	22	Weldon*	29	32	123	36	..
9	Laurel*	33	20	123	47	40	23	Countess*	29	10	122	36	..
10	Wellman's Fife	33	16	123	45	..	24	Early Riga*	28	48	113	38	..
11	White Russian	33	8	124	39	..	25	Red Fern	28	30	120	33	20
12	Preston*	32	56	120	52	..	26	McKendry's Fife (Minn. 181)	26	35	125	40	..
13	Stanley*	32	40	120	42	..							
14	Chester*	31	56	121	39	..							

The average crop of the twenty-six varieties of spring wheat tested on the Experimental Farm at Brandon, Man., in 1905 was 41 bushels 49 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston*	45	18	127	37	40	14	Red Fife	41	7	131	37	40
2	Stanley*	45	15	126	40	20	15	Advance*	41	5	129	30	..
3	Huron*	45	5	122	43	40	16	White Fife	40	57	130	43	20
4	Percy*	44	7	126	41	40	17	Countess*	40	43	125	33	20
5	Power's Fife (Minn. 149)	43	38	133	40	20	18	Colorado	40	18	129	31	..
6	Wellman's Fife	43	12	131	43	..	19	Laurel*	40	14	133	40	20
7	Monarch	42	44	130	35	..	20	Pringle's Champlain	40	1	130	28	..
8	Minnesota No. 163	42	24	133	46	..	21	Clyde*	39	42	126	30	20
9	McKendry's Fife (Minn. 181)	42	19	134	43	..	22	Haynes' Blue Stem (Minn. 169)	39	7	134	43	40
10	White Russian†	41	50	127	n. sown.		23	Chester*	38	57	128	38	..
11	Weldon*	41	24	129	23	20	24	Australian No. 9	38	44	130	41	20
12	Red Fern	41	11	131	27	40	25	Herisson Bearded	38	27	132	26	40
13	Dawn*	41	9	123	41	40	26	Early Riga*	34	51	120	20	..

The average crop of the twenty-six varieties of spring wheat tested on the Experimental Farm at Indian Head in 1905 was 36 bushels 17 lbs. per acre.

SPRING WHEAT—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Stanley*	35	14	119	11	20	14	Clyde*	32	16	119	8	30
2	McKendry's Fife (Minn. 181)	34	44	121	9	50	15	Early Riga*	32	15	113	11	..
3	Colorado	34	14	118	9	40	16	Minnesota No. 163	32	12	122	10	20
4	Laurel*	33	46	120	10	..	17	Percy*	31	53	117	7	20
5	White Russian	33	27	121	12	40	18	Australian No. 9	31	50	119	10	30
6	Countess*	33	25	117	12	50	19	Haynes' Blue Stem (Minn. 169)	31	12	121	8	10
7	Red Fife	33	9	120	9	..	20	Wellman's Fife	31	6	121	11	10
8	Monarch	33	4	120	15	20	21	Dawn*	30	36	117	12	20
9	Chester*	32	57	118	13	20	22	Red Fern	30	27	121	10	40
10	White Fife	32	47	119	8	50	23	Huron*	30	26	123	8	20
11	Preston*	32	39	115	5	20	24	Herisson Bearded	30	17	120	14	..
12	Advance*	32	31	115	9	30	25	Pringle's Champlain	28	52	120	5	40
13	Power's Fife (Minn. 149)	32	28	122	5	50	26	Weldon*	28	40	121	9	10

The average crop of the twenty-six varieties of spring wheat tested on the Experimental Farm at Agassiz in 1905 was 10 bushels 2 lbs. per acre, this very low yield being due to the ravages of the wheat midge.

DURUM OR MACARONI WHEAT.

The results of the tests of varieties of macaroni wheat are published in a separate table, as these wheats possess qualities rather different from those of the ordinary sorts of spring wheat. While it is possible to make good flour from some kinds of macaroni wheat, such flour is generally unpopular. Furthermore the peculiar character of the kernels necessitates the use of somewhat different methods in the milling of these kinds of wheat. They are naturally, therefore, looked upon with disfavour by millers.

Farmers who grow any of these varieties should exercise great care to prevent them from becoming mixed with the standard sorts used for flour making.

Four varieties of macaroni wheat have been grown on the uniform test plots during the past season. The plots were of the same size as those sown with ordinary spring wheat and the seed was used at the rate of one and three-quarter bushels per acre. The dates of sowing were as follows:—At Ottawa, Ont., April 20; Nappan, N. S., May 13; Brandon, Man., April 10 to 12; Indian Head, Sask., April 6; and at Agassiz, B.C., April 18.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Average yield for 1905.		Varieties tested for less than five years.	Average yield for two years.		Average days maturing.	Average yield for 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
1	Roumanian	37	55	121	33	32	Yellow Gharnovka (2 yrs)	33	2	119	34	20
2	Goose	36	23	119	30	32	Mahmoudi (2 years)	29	3	120	28	4

The average crop of the four varieties of macaroni wheat tested on all the Experimental Farms in 1905 was 31 bushels 37 lbs. per acre.

MACARONI WHEAT—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1905.		Varieties tested for less than five years.	Average yield for two years.		Average days maturing.	Yield for 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
1	Roumanian.....	34	34	113	40	20	Yellow Gharnovka (2 yrs)	34	10	105	37	.
2	Goose.....	26	58	109	20	40	Mahmoudi (2 years).....	23	10	107	20	20

The average crop of the four varieties of macaroni wheat tested on the Central Experimental Farm in 1905 was 29 bushels 35 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1905.		Varieties tested for less than five years.	Average yield for two years.		Average days maturing.	Yield for 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
1	Roumanian.....	29	4	115	22	..	Yellow Gharnovka (2 yrs)	15	20	106	16	40
2	Goose....	25	20	114	17	20	Mahmoudi (2 years).....	11	..	106	14	..

The average crop of the four varieties of macaroni wheat tested on the Experimental Farm at Nappan in 1905 was 17 bushels 30 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing.	Yield for 1905.		Varieties tested for less than five years.	Average yield for two years.		Average days maturing.	Yield for 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
1	Goose.....	47	4	126	49	..	Yellow Gharnovka (2 yrs)	49	30	133	54	..
2	Roumanian.....	44	24	126	50	..	Mahmoudi (2 years).....	45	40	136	46	40

The average crop of the four varieties of macaroni wheat tested on the Experimental Farm at Brandon in 1905 was 49 bushels 40 lbs. per acre.

MACARONI WHEAT—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.	Average days maturing.	Yield for 1905.	Varieties tested for less than five years.	Average yield for two years.	Average days maturing.	Yield for 1905.
		Bu. Lbs.	Days.	Bu. Lbs.		Bu. Lbs.	Days.	Bu. Lbs.
1	Goose	49 43	130	54 40	Mahmoudi (2 years)	47 25	135	51 20
2	Roumanian	47 58	131	46 40	Yellow Gharnovka (2 yrs)	46 52	136	52 ..

The average crop of the four varieties of macaroni wheat tested on the Experimental Farm at Indian Head in 1905 was 51 bushels 10 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.	Average days maturing.	Yield for 1905.	Varieties tested for less than five years.	Average yield for two years.	Average days maturing.	Yield for 1905.
		Bu. Lbs.	Days.	Bu. Lbs.		Bu. Lbs.	Days.	Bu. Lbs.
1	Roumanian	33 36	120	8 40	Mahmoudi (2 years)	19 20	117	12 ..
2	Goose	32 50	118	11 ..	Yellow Gharnovka (2 yrs)	18 ..	117	8 ..

The average crop of the four varieties of macaroni wheat tested on the Experimental Farm at Agassiz in 1905 was 9 bushels 55 lbs. per acre. This very low yield was due to the prevalence of the wheat midge *Diplosis tritici* which destroyed a large proportion of the crop.

EMMER AND SPELT.

Two varieties of emmer and two of spelt were sown in the uniform test plots this season. They are arranged in the tables in the order of their yield for two years.

The plots were of the same size as those of spring wheat. The dates of sowing were as follows :—At Ottawa, Ont., April 20 ; Nappan, N.S., May 13 ; Brandon, Man., April 10 to 12 ; Indian Head, Sask. April 8 ; and at Agassiz, B.C., April 18.

The yield is expressed in pounds per acre, the grain being of course, weighed with the husk adhering.

EMMER AND SPELT—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Average yield for 1905.	Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Average yield for 1905.
		Lbs.	Days.	Lbs.			Lbs.	Days.	Lbs.
1	Common Emmer.....	2,280	117	2,112	3	Red Emmer..	1,992	121	2,004
2	Red Spelt.....	2,153	121	2,498	4	White Spelt.....	1,915	121	2,468

The average crop of the four varieties of emmer and spelt tested on all the Experimental Farms in 1905 was 2,270 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield for 1905.	Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield for 1905.
		Lbs.	Days.	Lbs.			Lbs.	Days.	Lbs.
1	Red Emmer.....	2,320	109	1,880	3	Common Emmor.....	2,050	102	2,060
2	White Spelt.....	2,070	108	2,400	4	Red Spelt.....	1,930	112	1,620

The average crop of the four varieties of emmer and spelt tested on the Central Experimental Farm in 1905 was 1,990 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT NAPPAN, N.S.

Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield for 1905.	Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield for 1905.
		Lbs.	Days.	Lbs.			Lbs.	Days.	Lbs.
1	Red Spelt.....	1,920	111	2,440	3	Red Emmer.....	1,060	110	1,120
2	White Spelt.....	1,740	111	2,360	4	Common Emmer.....	960	105	880

The average crop of the four varieties of emmer and spelt tested on the Experimental Farm at Nappan in 1905 was 1,700 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT BRANDON, MAN.

Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield for 1905.	Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield for 1905.
		Lbs.	Days.	Lbs.			Lbs.	Days.	Lbs.
1	Common Emmer.....	3,490	132	2,840	3	Red Emmer.....	2,640	139	2,500
2	Red Spelt.....	2,750	135	3,500	4	White Spelt.....	1,760	135	2,280

The average crop of the four varieties of emmer and spelt tested on the Experimental Farm at Brandon in 1905 was 2,780 lbs. per acre.

EMMER AND SPELT—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT INDIAN HEAD, SASK.

Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield in 1905.	Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield in 1905.
		Lbs.	Days.	Lbs.			Lbs.	Days.	Lbs.
1	Common Emmer.....	3,020	130	2,940	3	Red Emmer.....	2,280	132	3,040
2	Red Spelt.....	2,570	132	3,420	4	White Spelt	2,230	132	3,340

The average crop of the four varieties of emmer and spelt tested on the Experimental Farm at Indian Head in 1905 was 3,185 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT AGASSIZ, B.C.

Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield in 1905.	Number.	Varieties tested for two years.	Average yield for two years.	Average days maturing.	Yield in 1905.
		Lbs.	Days.	Lbs.			Lbs.	Days.	Lbs.
1	Common Emmer.....	1,880	117	1,840	3	Red Emmer.....	1,660	117	1,480
2	White Spelt.....	1,775	117	1,960	4	Red Spelt.....	1,595	117	1,510

The average crop of the four varieties of emmer and spelt tested on the Experimental Farm at Agassiz in 1905 was 1,697 lbs. per acre.

OATS.

During the season of 1905, thirty-nine varieties of oats have been under trial. The size of the plots on which they were grown was the same as in the case of spring wheat. The seed was generally sown at the rate of two bushels per acre, and the dates of sowing were as follows:—At Ottawa, Ont., April 26 and 27; Nappan, N. S., May 15; Brandon, Man., April 27 and 28; Indian Head, Sask., April 26; and at Agassiz, B.C., April 15.

In Canada the bushel of oats is 34 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Banner.....	85	24	110	87	20	16	Early Golden Prolific.	79	18	111	79	28
2	Abundance.....	84	28	110	88	28	17	Golden Giant.....	79	14	115	82	16
3	Lincoln.....	83	30	111	84	28	18	Goldfinder.....	79	..	114	93	10
4	Danish Island.....	83	3	111	82	18	19	Thousand Dollar.....	78	13	110	78	22
5	Improved American..	82	22	111	94	11	20	Buckbee's Illinois ...	78	10	111	79	2
6	Siberian.....	82	..	112	93	18	21	American Beauty....	77	28	110	79	22
7	Wide Awake.....	81	14	111	79	30	22	Waverley.....	77	13	111	87	22
8	Holstein Prolific.....	81	6	110	83	32	23	Black Beauty.....	76	27	109	81	32
9	White Giant.....	81	2	111	85	16	24	Irish Victor.....	76	22	110	78	16
10	Golden Beauty.....	80	30	111	85	6	25	Joanette.....	76	11	112	86	28
11	Golden Tartarian....	80	20	115	86	30	26	Improved Ligowo....	76	9	109	84	24
12	Columbus.....	80	2	111	79	30	27	Sensation	76	8	109	77	4
13	Mennonite	79	31	109	89	16	28	Pioneer	75	11	109	88	24
14	Bavarian.....	79	26	110	89	26	29	Tartar King.....	73	24	108	84	20
15	American Triumph...	79	25	112	82	24	30	Scotch Potato.....	69	26	112	76	20

OATS—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS—*Continued.*

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Average yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Average yield in 1905.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Twentieth Century (4 years)	84	16	111	82	26	Swedish Select (3 years)	77	33	110	80	12
Golden Fleece (3 years)	85	3	113	90	12	Olive Black* (3 years)	77	9	114	77	22
Kendal White* (3 years)	83	13	112	84	26	Kendal Black* (3 years)	75	16	114	73	2
Milford White* (3 years)	78	13	112	76	16	Milford Black* (3 years)	73	23	113	67	8
						Storm King (2 years)	69	8	108	76	32

The average crop of the thirty nine varieties of oats tested on all the Experimental Farms in 1905 was 83 bushels, 6 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Banner	70	32	105	84	4	16	Black Beauty	61	18	105	68	28
2	Lincoln	70	32	105	73	18	17	Thousand Dollar	60	32	104	70	20
3	White Giant	70	8	107	84	4	18	Buckbee's Illinois	60	12	106	62	12
4	Mennonite	69	30	104	72	12	19	Early Golden Prolific	60	12	106	71	26
5	American Triumph	67	30	107	70	..	20	Golden Giant	59	30	110	52	12
6	Improved American	67	22	107	77	22	21	Bavarian †	59	16	107	77	22
7	Columbus †	67	20	107	64	4	22	Pioneer	59	2	105	74	24
8	Golden Beauty	67	14	104	70	20	23	Goldfinder	58	4	108	71	26
9	Abundance	66	24	105	72	32	24	Improved Ligowo	58	..	105	68	28
10	Wide Awake	66	20	106	67	2	25	Joanette	57	18	108	63	18
11	Sensation	65	26	106	52	32	26	Siberian	56	12	108	62	32
12	Holstein Prolific	65	10	106	71	6	27	Golden Tartarian	54	8	111	75	10
13	Irish Victor	63	6	106	67	22	28	Tartar King	52	4	103	65	30
14	Danish Island	62	16	106	75	10	29	Waverley	51	10	106	68	8
15	American Beauty	61	22	103	69	14	30	Scotch Potato	51	..	108	67	2

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Twentieth Century (4 years)	77	22	106	72	32	Kendal Black * (3 years)	65	30	105	67	22
Milford White * (3 years)	70	33	103	68	8	Golden Fleece † (3 years)	65	9	106	67	2
Swedish Select † (3 years)	69	7	105	67	2	Milford Black * (3 years)	61	6	104	61	26
Kendal White * (3 years)	66	29	104	62	32	Olive Black * (3 years)	58	21	106	67	22
						Storm King (2 years)	41	6	100	61	26

The average crop of the thirty-nine varieties of oats tested on the Central Experimental Farm in 1905 was 69 bushels 1 lb. per acre.

OATS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Siberian	83	10	111	82	12	16	Improved American	73	6	109	72	32
2	Improved Ligowo	79	10	107	92	32	17	Holstein Prolific	72	32	108	65	10
3	Sensation	78	32	106	77	2	18	Abundance	72	16	107	58	28
4	Lincoln	78	24	110	75	30	19	American Beauty	72	..	110	61	6
5	Thousand Dollar	78	..	108	80	..	20	Golden Giant	71	30	114	72	32
6	Banner	77	26	107	75	10	21	Waverley	71	14	108	76	16
7	White Giant	77	2	110	62	32	22	Early Golden Prolific	71	2	109	45	30
8	Mennonite	76	32	109	90	20	23	Golden Beauty	69	30	109	69	14
9	Joanette	76	24	105	83	18	24	Wide Awake	69	22	109	56	16
10	Bavarian	76	8	108	78	28	25	Columbus	68	28	110	62	32
11	Goldfinder	75	10	112	67	2	26	Buckbee's Illinois	67	18	110	70	20
12	Golden Tartarian	75	2	115	62	12	27	Tartar King	65	30	105	50	20
13	Pioneer	75	2	106	77	22	28	Irish Victor	63	26	107	56	16
14	Black Beauty	73	30	103	80	..	29	American Triumph	62	26	114	57	22
15	Danish Island	73	22	110	65	30	30	Scotch Potato	62	20	109	45	30

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Twentieth Century (4 years)	83	20	107	85	30	Kendal White * (3 years)	65	..	106	64	14
Swedish Select (3 years)	78	1	104	74	4	Kendal Black * (3 years)	61	6	106	55	10
Golden Fleece (3 years)	71	33	106	65	10	Milford Black * (3 years)	60	27	105	47	2
Olive Black * (3 years)	68	28	107	70	..	Milford White * (3 years)	55	17	105	46	16
						Storm King (2 years)	54	4	99	57	22

The average crop of the thirty-nine varieties of oats tested on the Experimental Farm at Nappan in 1905, was 67 bushels, 25 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Improved American	103	18	109	134	4	16	Golden Tartarian	96	..	114	117	22
2	Abundance	103	12	109	121	6	17	Irish Victor	95	28	109	112	32
3	Siberian	103	8	110	118	28	18	Columbus	95	6	108	103	18
4	Wide Awake	102	8	111	117	22	19	Bavarian	94	32	109	121	26
5	Buckbee's Illinois	101	26	111	111	26	20	American Beauty	93	18	108	110	..
6	Early Golden Prolific	101	1	109	112	32	21	Thousand Dollar	92	2	109	105	30
7	Golden Beauty	100	8	110	129	14	22	Mennonite	91	14	106	111	6
8	Danish Island	100	8	109	104	4	23	Goldfinder	91	..	113	132	12
9	Golden Giant	100	8	114	135	10	24	Joanette	88	10	112	107	2
10	Lincoln	99	10	109	108	28	25	Black Beauty	86	22	109	114	4
11	American Triumph	99	2	110	113	18	26	Scotch Potato	86	12	111	114	4
12	Banner	98	24	110	122	12	27	Pioneer	84	8	108	120	20
13	Waverley	97	29	110	118	8	28	Tartar King	84	6	107	115	10
14	Holstein Prolific	97	4	108	114	4	29	Sensation	82	32	108	98	28
15	White Giant	96	14	109	117	2	30	Improved Ligowo	78	26	107	97	22

OATS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.—*Continued.*

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Twentieth Century (4 yrs)	102	15	113	95	10	Milford White * (3 years)	91	6	116	90	20
Golden Fleece (3 years)..	109	27	112	125	10	Milford Black * (3 years).	91	3	117	82	12
Kendal White * (3 years).	102	19	114	107	22	Swedish Select (3 years).	84	11	111	104	24
Olive Black * (3 years)...	96	16	117	97	22	Storm King (2 years)....	93	8	116	96	16
Kendal Black * (3 years).	93	11	118	92	32						

The average crop of the thirty-nine varieties of oats tested on the Experimental Farm at Brandon in 1905 was 111 bushels, 23 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Banner.....	114	24	112	95	10	16	Early Golden Prolific.	100	4	113	109	14
2	Abundance.....	108	..	112	95	30	17	Mennonite.....	99	16	111	106	16
3	Danish Island.....	107	8	111	104	24	18	Thousand Dollar.....	99	13	110	73	18
4	Golden Beauty.....	106	17	112	110	20	19	Improved Ligowo....	98	13	110	101	6
5	Improved American..	105	1	112	105	10	20	Irish Victor.....	97	10	114	98	8
6	Goldfinder.....	104	24	117	117	22	21	Buckbee's Illinois....	96	27	110	101	6
7	Golden Tartarian.....	103	26	116	111	6	22	Waverley.....	96	27	113	101	6
8	Wide Awake.....	103	25	111	99	14	23	Siberian.....	96	3	116	111	26
9	Columbus.....	103	17	114	110	20	24	Joanette.....	95	22	118	111	26
10	American Triumph...	103	10	113	110	..	25	White Giant.....	94	3	111	104	24
11	Golden Giant.....	102	26	117	104	24	26	Pioneer.....	93	16	114	112	32
12	American Beauty....	101	23	113	101	6	27	Tartar King.....	92	13	112	110	..
13	Holstein Prolific.....	101	23	111	101	26	28	Black Beauty.....	89	26	112	74	24
14	Lincoln.....	101	..	112	102	12	29	Scotch Potato.....	89	9	114	107	2
15	Bavarian.....	100	18	112	100	..	30	Sensation.....	88	31	111	82	12

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Twentieth Century (4 years).....	103	18	116	110	20	Olive Black* (3 years)....	101	12	123	92	12
Kendal White* (3 years)	111	19	119	108	28	Swedish Select (3 years)..	100	23	117	94	24
Milford White* (3 years)	104	4	120	102	12	Milford Black* (3 years)..	100	9	123	84	24
Golden Fleece (3 years)..	101	14	123	101	6	Kendal Black* (3 years)..	96	29	123	89	14
						Storm King (2 years).....	96	16	115	99	14

The average crop of the thirty-nine varieties of oats tested on the Experimental Farm at Indian Head in 1905 was 101 bushels, 19 lbs. per acre.

OATS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Tartar King	74	1	115	81	6	16	Columbus	65	8	115	58	6
2	Golden Tartarian	73	28	120	67	32	17	Buckbee's Illinois	65	2	118	49	14
3	Abundance	73	22	117	95	10	18	Early Golden Prolific	65	2	116	59	2
4	Black Beauty	72	4	114	72	2	19	Improved American	64	30	117	82	22
5	Danish Island	71	30	119	62	22	20	Wide Awake	64	29	118	58	26
6	Siberian	71	..	117	91	26	21	Pioneer	64	28	113	57	22
7	Waverley	69	20	116	74	4	22	Sensation	64	20	115	74	14
8	Lincoln	69	14	117	63	18	23	Joanette	63	16	116	68	8
9	Holstein Prolific	68	28	116	67	12	24	Irish Victor	63	5	116	57	2
10	Bavarian	67	20	116	70	20	25	Golden Giant	62	10	119	47	2
11	White Giant	67	18	117	58	16	26	Mennonite	61	29	114	66	26
12	Improved Ligowo	66	32	116	62	32	27	Thousand Dollar	61	20	117	63	8
13	Banner	66	16	116	60	28	28	Golden Beauty	60	15	118	45	30
14	Goldfinder	65	32	118	77	22	29	American Beauty	60	8	118	56	16
15	American Triumph	65	24	117	62	12	30	Scotch Potato	59	22	118	48	28

Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average days maturing.	Yield in 1905.	
	Bu.	Lbs.	Days.	Bu.	Lbs.		Bu.	Lbs.	Days.	Bu.	Lbs.
Twentieth Century (4 years)	55	7	114	49	4	Olive Black * (3 years)	61	2	115	60	18
Golden Fleece (3 years)	77	2	116	92	32	Kendal Black * (3 years)	60	3	116	59	32
Kendal White* (3 years)	70	33	117	80	..	Swedish Select (3 years)	57	23	114	61	4
Milford White * (3 years)	70	5	115	74	24	Milford Black * (3 years)	55	3	114	60	8
						Storm King (2 years)	61	6	111	69	14

The average crop of the thirty-nine varieties of oats tested on the Experimental Farm, at Agassiz, in 1905, was 65 bushels, 31 lbs. per acre.

SIX-ROWED BARLEY.

During the season of 1905, eighteen varieties of six-rowed barley have been under test. The plots were of the same size as those sown with spring wheat. The seed was used in the proportion of two bushels to the acre; and the dates of sowing were as follows:—At Ottawa, Ont., April 26; Nappan, N.S., May 16; Brandon, Man., May 16 to 23; Indian Head, Sask., April 29; and at Agassiz, B.C., April 15.

In Canada the bushel of barley is 48 lbs.

SIX-ROWED BARLEY—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mensury	56	38	97	63	22	10	Summit*	51	47	99	53	40
2	Odessa	54	37	96	55	12	11	Empire*	51	11	98	50	16
3	Nugent*	54	2	100	59	36	12	Mansfield*	50	44	98	54	16
4	Stella*	53	2	100	59	22	13	Trooper*	50	38	98	50	28
5	Brome*	52	46	99	57	14	14	Royal*	50	37	97	49	36
6	Claude*	52	43	98	54	16	15	Albert*	50	22	97	59	12
7	Common	52	35	95	57	8	16	Argyle*	50	3	98	55	20
8	Yale*	52	27	99	53	44	17	Rennie's Improved	49	4	95	51	22
9	Oderbruch	52	5	96	56	8	18	Champion	40	38	93	40	32

The average crop of the eighteen varieties of six-rowed barley tested on all the Experimental Farms in 1905 was 54 bushels 28 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield i 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Stella*	53	26	94	55	20	10	Albert*	45	34	95	70	40
2	Odessa	52	2	93	66	12	11	Oderbruch	45	14	95	68	16
3	Nugent*	51	34	96	72	24	12	Claude*	43	10	96	62	24
4	Mensury	51	8	93	71	12	13	Royal*	42	10	95	54	28
5	Trooper*	47	42	93	69	8	14	Argyle*	41	26	96	56	12
6	Yale*	47	42	95	49	28	15	Rennie's Improved	40	46	93	43	16
7	Brome*†	47	24	95	61	12	16	Empire*	39	30	95	42	4
8	Summit*	46	42	93	63	36	17	Mansfield*†	34	12	96	46	32
9	Common	46	6	92	65	20	18	Champion†	33	36	92	40	..

The average crop of the eighteen varieties of six-rowed barley tested on the Central Experimental Farm in 1905 was 58 bushels 40 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Common	56	16	92	47	24	10	Brome*	48	16	97	49	8
2	Mensury	52	40	95	48	16	11	Yale*	47	24	97	33	16
3	Oderbruch	52	8	92	34	8	12	Nugent*	47	24	96	31	32
4	Empire*	50	40	95	41	32	13	Argyle*	45	32	93	37	24
5	Royal*	49	24	94	39	8	14	Rennie's Improved	44	36	92	34	28
6	Odessa	49	20	92	31	12	15	Claude*	44	28	93	31	12
7	Albert*	49	8	92	49	8	16	Summit*	44	12	98	38	36
8	Stella*	49	8	98	45	..	17	Mansfield*	44	8	96	30	40
9	Trooper*	49	4	93	34	28	18	Champion	43	40	91	38	16

The average crop of the eighteen varieties of six-rowed barley tested on the Experimental Farm at Nappan in 1905 was 38 bushels 33 lbs. per acre.

SIX-ROWED BARLEY—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mansfield*	61	34	91	77	24	10	Empire*	53	24	93	55	40
2	Mensury	60	8	91	75	20	11	Albert*	52	40	90	66	12
3	Yale*	59	16	93	63	36	12	Oderbruch	51	12	90	65	40
4	Summit*	57	34	93	64	28	13	Trooper*	51	12	94	53	16
5	Brome*	55	40	94	62	4	14	Rennie's Improved	50	..	89	66	32
6	Claude*	55	4	93	58	16	15	Common	49	44	88	60	..
7	Nugent*	55	2	93	60	20	16	Stella*	49	44	93	63	36
8	Argyle*	55	..	92	67	4	17	Royal*	48	26	90	50	..
9	Odessa	54	10	90	68	16	18	Champion	35	5	87	42	44

The average crop of the eighteen varieties of six-rowed barley tested on the Experimental Farm at Brandon in 1905 was 62 bushels 16 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Claude*	67	44	101	74	8	10	Common	58	40	98	65	20
2	Odessa	65	44	100	62	4	11	Brome*	58	34	102	61	12
3	Nugent*	62	4	106	78	36	12	Trooper*	58	15	99	62	24
4	Mansfield*	61	1	99	70	..	13	Yale*	57	34	102	73	16
5	Mensury	60	46	99	69	8	14	Rennie's Improved	56	19	98	63	16
6	Summit*	60	28	104	62	44	15	Oderbruch	55	21	97	62	24
7	Stella*	60	23	102	82	44	16	Argyle*	54	28	100	62	4
8	Royal*	60	16	99	60	40	17	Albert*	50	26	99	57	24
9	Empire*	59	8	102	62	24	18	Champion	41	15	95	36	12

The average crop of the eighteen varieties of six-rowed barley tested on the Experimental Farm at Indian Head in 1905 was 64 bushels, 41 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mensury	58	38	106	53	6	10	Royal*	53	12	105	44	8
2	Oderbruch	56	20	104	50	..	11	Empire*	53	..	107	49	28
3	Brome*	54	18	107	52	34	12	Common	52	20	105	47	24
4	Albert*	54	..	107	52	24	13	Odessa	52	14	104	48	16
5	Nugent*	53	44	109	55	20	14	Stella*	52	6	111	50	10
6	Claude*	53	32	106	45	20	15	Summit*	50	24	109	39	8
7	Argyle*	53	24	107	54	8	16	Yale*	50	20	109	49	28
8	Mansfield*	53	20	108	46	32	17	Champion	49	46	102	45	40
9	Rennie's Improved	53	16	104	49	8	18	Trooper*	47	20	111	33	16

The average crop of the eighteen varieties of six-rowed barley tested on the Experimental Farm at Agassiz in 1905 was 48 bushels, 8 lbs. per acre.

TWO-ROWED BARLEY.

Fourteen varieties of two-rowed barley were tested, during the season of 1905, on all the Experimental Farms. The plots were of the same size as those of spring wheat. The seed was used at the rate of two bushels per acre; and the dates of sowing were as follows:—At Ottawa, Ont., April 25; Nappan, N.S., May 16; Brandon, Man., May 16 to 23; Indian Head, Sask., April 27 and 29; and at Agassiz, B.C., April 15.

In Canada the bushel of barley is 48 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	French Chevalier	51	2	103	52	34	8	Harvey *	46	3	100	48	16
2	Danish Chevalier	50	10	103	51	28	9	Logan *	45	25	100	43	..
3	Standwell	50	1	104	49	24	10	Clifford *	45	24	99	47	..
4	Canadian Thorpe	48	42	102	48	..	11	Sidney *	45	23	99	43	12
5	Beaver *	48	36	101	54	16	12	Newton	45	6	103	47	24
6	Invincible	48	6	103	51	32	13	Dunham *	45	2	100	41	20
7	Gordon *	46	32	100	47	36	14	Jarvis *	44	46	99	46	42

The average crop of the fourteen varieties of two-rowed barley tested on all the Experimental Farms in 1905 was 48 bushels, 3 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	French Chevalier	54	22	98	60	..	8	Jarvis *	41	2	95	46	12
2	Danish Chevalier	48	40	98	62	44	9	Invincible	40	36	100	45	..
3	Canadian Thorpe	48	10	99	42	24	10	Logan *	40	6	99	50	..
4	Standwell	44	34	99	54	8	11	Sidney *	38	2	97	42	24
5	Beaver *	44	2	95	47	24	12	Newton	36	40	100	33	16
6	Gordon *	42	22	97	41	12	13	Harvey *	36	26	100	50	..
7	Clifford *	42	8	97	53	16	14	Dunham *	35	26	99	40	40

The average crop of the fourteen varieties of two-rowed barley tested on the Central Experimental Farm in 1905 was 47 bushels 40 lbs. per acre.

TWO-ROWED BARLEY—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Danish Chevalier...	52	34	97	42	44	8	Harvey*.....	39	32	97	39	8
2	French Chevalier....	50	4	97	44	28	9	Invincible.....	39	26	98	35	20
3	Beaver*.....	49	16	95	43	16	10	Standwell.....	39	24	99	25	..
4	Newton.....	44	44	97	38	36	11	Sidney*.....	39	..	97	35	..
5	Canadian Thorpe....	42	8	98	34	8	12	Clifford*.....	37	34	97	33	16
6	Logan*.....	40	40	97	38	16	13	Gordon*.....	36	16	97	35	40
7	Dunham*.....	39	36	97	34	28	14	Jarvis*.....	33	8	96	36	32

The average crop of the fourteen varieties of two-rowed barley tested on the Experimental Farm at Nappan in 1905 was 36 bushels, 45 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Harvey*.....	52	12	93	63	16	8	Invincible.....	44	38	94	53	36
2	Gordon*..... ...	51	17	95	67	44	9	Sidney*	44	24	91	48	16
3	Dunham*.....	51	14	92	53	36	10	French Chevalier....	43	22	96	62	4
4	Jarvis*.....	50	38	92	63	36	11	Canadian Thorpe.....	42	36	95	56	32
5	Logan*..	49	16	94	52	44	12	Danish Chevalier....	42	32	97	60	40
6	Clifford*.....	48	6	93	54	8	13	Beaver*.....	42	4	96	54	28
7	Standwell.....	46	19	96	59	28	14	Newton.....	39	26	96	53	16

The average crop of the fourteen varieties of two-rowed barley tested on the Experimental Farm at Brandon in 1905 was 57 bushels, 24 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Standwell.....	66	34	110	62	4	8	Beaver*	54	5	107	75	..
2	Invincible.....	66	26	109	74	28	9	Jarvis*..	53	25	101	50	..
3	Danish Chevalier.....	58	14	111	55	20	10	Clifford*..	53	20	99	51	32
4	Sidney*..... .. .	56	33	98	51	12	11	Harvey*	52	15	99	47	24
5	Canadian Thorpe....	56	18	105	55	..	12	Newton	52	10	110	57	4
6	French Chevalier....	56	14	111	50	20	13	Logan*.....	50	47	101	47	44
7	Gordon*.....	55	19	100	64	28	14	Dunham*..... ..	45	29	102	41	32

The average crop of the fourteen varieties of two-rowed barley tested on the Experimental Farm at Indian Head in 1905 was 56 bushels, 1 lb. per acre.

TWO-ROWED BARLEY—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Canadian Thorpe	54	42	112	51	32	8	Sidney*	49	10	114	39	8
2	Beaver*	54	8	112	51	12	9	Invincible	48	46	113	49	28
3	Dunham*	53	..	112	36	12	10	Danish Chevalier	48	24	114	35	40
4	Standwell	52	36	114	46	32	11	Gordon*	47	37	110	29	8
5	Newton	52	4	111	55	..	12	Logan*	46	14	111	25	40
6	French Chevalier	50	44	115	46	22	13	Jarvis*	46	14	110	37	34
7	Harvey*	49	24	109	41	32	14	Clifford*	46	4	109	42	24

The average crop of the fourteen varieties of two-rowed barley tested on the Experimental Farm at Agassiz in 1905 was 42 bushels, 3 lb. per acre.

PEASE.

Twenty-six varieties of pease have been under trial at all the Experimental Farms during the past season. The plots were of the same size as those sown with spring wheat. The quantity of seed used per acre varied from two to three bushels, depending on the size of the pea. The dates of sowing were as follows:—At Ottawa, Ont., April, 28; Nappan, N.S., May 23; Brandon, Man., April 19 and 20; Indian Head, Sask., May 2; and at Agassiz, B.C., April 18.

In Canada the bushel of pease is 60 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Average yield in 1905.	
		Bu.	Lbs	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mackay*	41	2	120	42	50	14	Victoria*	38	31	122	38	..
2	English Grey	40	54	119	44	36	15	Archer*	38	30	120	35	16
3	Early Britain	40	54	116	43	4	16	German White	38	30	116	40	8
4	Agnes*	40	12	117	40	26	17	Carleton*	38	26	120	37	32
5	Prince*	40	5	119	38	54	18	Pearl*	38	24	120	36	24
6	Golden Vine	39	57	116	44	8	19	Prussian Blue	38	19	115	36	20
7	Arthur*	39	52	115	37	10	20	Nelson*	38	12	115	37	..
8	Gregory*	39	49	119	43	52	21	Kent*	38	1	121	37	48
9	White Wonder	39	27	114	45	22	22	Prince Albert	37	54	119	36	58
10	Macoun*	39	23	120	35	8	23	Daniel O'Rourke	37	48	115	37	32
11	Picton*	39	15	117	39	36	24	Wisconsin Blue	37	34	118	36	16
12	White Marrowfat	38	58	119	39	28	25	Duke*	37	33	120	40	44
13	Chancellor	38	56	114	45	56	26	Blk-eye Marrowfat	37	30	118	40	16

The average crop of the twenty-six varieties of pease tested on all the Experimental Farms in 1905 was 39 bushels, 39 lbs. per acre.

PEASE—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Golden Vine	36	44	110	39	40	14	Agnes*	31	52	110	38	20
2	Victoria*	35	..	117	38	..	15	Pearl*	31	40	111	37	20
2	Mackay*	34	44	111	34	..	16	Nelson*	31	..	107	22	40
4	White Wonder	34	44	107	48	40	17	Arthur*	30	56	109	27	40
5	Prince*	34	32	111	35	40	18	Early Britain	30	56	112	36	40
6	Prussian Blue	34	16	109	34	..	19	Duke*	30	48	112	35	..
7	English Grey	34	..	113	35	40	20	Archer*	30	24	114	25	..
8	Picton*	33	56	111	39	..	21	Wisconsin Blue	30	8	112	29	40
9	Chancellor	33	20	107	38	20	22	German White	30	4	108	41	20
10	Kent*	33	4	113	27	..	23	White Marrowfat	29	48	112	29	..
11	Daniel O'Rourke	32	36	109	29	40	24	Blk-eye Marrowfat	29	32	114	31	..
12	Gregory*	32	28	113	41	40	25	Carleton*	28	12	113	30	..
13	Prince Albert	31	56	113	25	20	26	Macoun*	28	8	115	27	..

The average crop of the twenty-six varieties of pease tested on the Central Experimental Farm in 1905, was 33 bushels, 45 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Agnes*	35	44	115	24	40	14	Blk-eye Marrowfat	30	16	114	34	..
2	Archer*	35	32	114	24	20	15	Duke*	29	52	113	40	30
3	Arthur*	35	12	110	30	40	16	Pearl*	29	48	116	25	40
4	Nelson*	34	24	111	38	..	17	Golden Vine	29	28	111	30	..
5	Prince Albert	33	24	114	31	..	18	Picton*	29	8	114	31	30
6	White Marrowfat	32	52	114	35	40	19	German White	28	56	111	28	..
7	Gregory*	32	32	116	26	40	20	Kent*	28	32	116	25	20
8	Macoun*	32	32	115	19	20	21	Wisconsin Blue	28	24	114	26	..
9	Mackay*	31	12	116	26	20	22	Early Britain	27	36	109	24	..
10	English Grey	31	12	115	37	20	23	Prince*	27	28	112	24	..
11	Carleton*	31	4	115	26	40	24	Prussian Blue	27	20	110	24	40
12	Victoria*	30	40	119	15	20	25	Daniel O'Rourke	26	48	109	30	..
13	Chancellor	30	20	105	31	40	26	White Wonder	25	12	109	34	..

The average crop of the twenty-six varieties of pease tested on the Experimental Farm at Nappan, in 1905, was 28 bushels, 40 lbs. per acre.

PEASE—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Macoun *	48	54	131	29	50	14	German White	44	4	127	40	..
2	Early Britain	48	54	125	51	40	15	Gregory*	43	28	131	44	..
3	Mackay *	47	44	130	45	40	16	Carleton *	43	20	132	31	40
4	Victoria *	47	18	133	36	20	17	White Marrowfat	43	18	132	38	..
5	Pearl *	47	..	134	40	20	18	Prussian Blue	41	34	124	42	..
6	Wisconsin Blue	46	54	125	41	40	19	Agnes *	41	26	128	37	..
7	Picton *	45	30	126	37	40	20	Prince Albert	41	26	134	33	20
8	Golden Vine	45	24	126	40	40	21	Daniel O'Rourke	41	26	128	35	40
9	English Grey	45	4	132	41	40	22	Kent *	41	20	133	38	..
10	Prince *	45	..	134	45	..	23	Duke *	40	30	130	37	40
11	White Wonder	44	44	122	44	20	24	Chancellor	39	22	119	41	20
12	Arthur *	44	30	125	40	20	25	Nelson *	38	58	124	31	..
13	Archer *	44	10	133	31	20	26	Blk-eye Marrowfat	38	12	124	38	20

The average crop of the twenty-six varieties of pease tested on the Experimental Farm at Brandon, in 1905 was 39 bushels, 1 lb. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu.	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	Daniel O'Rourke	54	50	112	57	..	14	Kent *	48	54	120	70	..
2	Early Britain	52	38	116	55	40	15	Golden Vine	48	42	115	67	40
3	Chancellor	52	18	115	69	20	16	Arthur *	47	46	114	45	40
4	Prussian Blue	52	18	115	53	..	17	Archer *	47	18	119	56	20
5	English Grey	51	42	116	58	20	18	Macoun *	47	6	120	56	20
6	Prince *	51	38	116	48	40	19	German White	46	54	116	42	40
7	Gregory *	51	18	118	62	..	20	Duke *	46	34	119	59	50
8	Picton *	50	54	114	56	..	21	Nelson *	46	34	118	57	40
9	Carleton *	50	54	120	53	..	22	Pearl *	46	30	118	52	..
10	Agnes *	50	50	115	61	40	23	Wisconsin Blue	45	30	119	47	40
11	Black-eye Marrowfat	50	46	118	57	..	24	White Marrowfat	43	42	118	51	..
12	White Wonder	50	42	111	57	40	25	Prince Albert	42	50	117	56	40
13	Mackay *	49	46	121	65	40	26	Victoria *	41	22	119	58	..

The average crop of the twenty-six varieties of pease tested on the Experimental Farm at Indian Head, in 1905 was 56 bushels, 59 lbs. per acre.

PEASE—*Concluded.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average days maturing for five years.	Yield in 1905.	
		Bu.	Lbs.	Days.	Bu	Lbs.			Bu.	Lbs.	Days.	Bu.	Lbs.
1	White Marrowfat....	45	10	121	43	40	14	Golden Vine.....	39	26	120	42	40
2	Early Britain.....	44	26	116	47	20	15	Gregory *.....	39	18	118	43	20
3	German White.....	42	34	117	48	40	16	Chancellor.....	39	18	122	48	40
4	English Grey... ...	42	30	117	50	..	17	Blk-eye Marrowfat...	38	44	119	41	..
5	White Wonder.....	41	54	119	42	10	18	Carleton *.....	38	42	120	41	20
6	Mackay *	41	52	121	42	10	19	Kent *.....	38	16	121	28	40
7	Prince *.	41	46	120	41	10	20	Victoria *.....	38	16	121	42	20
8	Agnes *.....	41	6	120	40	30	21	Pearl *.....	37	..	121	26	40
9	Arthur *.....	40	54	114	41	30	22	Wisconsin Blue.....	36	56	121	36	20
10	Macoun *.....	40	14	121	43	10	23	Picton *..... ...	36	46	121	34	..
11	Duke *.....	40	2	124	39	20	24	Prussian Blue.....	36	8	118	28	..
12	Nelson *.....	40	2	117	35	40	25	Archer *.....	35	4	122	39	20
13	Prince Albert.....	39	56	119	38	30	26	Daniel O'Rourke.....	33	20	115	35	20

The average crop of the twenty-six varieties of pease tested on the Experimental Farm at Agassiz in 1905 was 40 bushels, 3 lbs. per acre.

INDIAN CORN.

The number of varieties of Indian corn tested in 1905 was twenty. These were sown in rows about three feet apart, and the plants thinned out to six or eight inches apart in the rows. The dates of sowing were as follows:—At Ottawa, Ont, May 22; Nappan, N.S., June 9; Brandon, Man., May 19; Indian Head, Sask., May 19; and at Agassiz, B.C., April 18.

The crop in each case was cut green and put into the silo for the winter feeding of stock. The dates of cutting were:—At Ottawa, Ont., Sept. 11; Nappan, N.S., Sept. 29; Brandon, Man., Sept. 4; Indian Head, Sask., Sept. 8; and at Agassiz, B.C., Sept 26.

The yield per acre has been calculated in each case from the weight obtained from two rows each 66 feet long.

In Canada the ton is 2,000 lbs.

INDIAN CORN—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Thoroughbred White Flint	22	400	24	1230	10	Mammoth Cuban	17	1960	19	918
2	Salzer's All Gold	20	448	22	1188	11	Champion White Pearl	17	1688	19	148
3	Superior Fodder	19	1699	23	847	12	Longfellow	17	1490	23	1496
4	Pride of the North	19	1368	26	1284	13	Angel of Midnight	17	1132	20	1089
5	Red Cob Ensilage	19	865	23	1740	14	North Dakota White	17	632	21	262
6	Giant Prolific Ensilage	19	688	21	548	15	White Cap Yellow Dent	17	627	19	610
7	Compton's Early	18	1593	22	1012	16	Selected Leaming	16	1663	21	834
8	Early Butler	18	1046	21	896	17	Cloud's Early Yellow	16	703	19	258
9	Early Mastodon	18	984	20	568	18	Evergreen Sugar	15	941	18	40

Varieties tested for less than five years.	Average yield for less than five years.		Average yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (4 years)	20	1003	25	600	King Philip (4 years)	17	1992	20	370

The average crop of the twenty varieties of Indian corn tested on all the Experimental Farms in 1905 was 21 tons 1,397 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Thoroughbred White Flint	24	1984	33	880	10	Mammoth Cuban	21	1098	26	1900
						11	Cloud's Early Yellow	21	1076	32	1340
2	Superior Fodder	24	1484	32	900	12	Selected Leaming	21	944	31	700
3	Giant Prolific Ensilage	24	763	29	1620	13	Compton's Early	21	801	28	1310
4	Salzer's All Gold	23	1388	29	1620	14	Champion White Pearl	20	1745	27	1880
5	Early Butler	23	1058	28	1750	15	Evergreen Sugar	19	1864	29	520
6	Early Mastodon	23	915	30	60	16	North Dakota White	19	1534	26	1900
7	Red Cob Ensilage	23	486	32	1450	17	Longfellow	19	1292	31	920
8	Pride of the North	22	1668	33	1650	18	Angel of Midnight	17	1940	27	450
9	White Cap Yellow Dent	21	1298	27	450						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (4 years)	27	1275	37	1130	King Philip (4 years)	21	1670	30	940

The average crop of the twenty varieties of Indian corn tested on the Central Experimental Farm at Ottawa in 1905 was 30 tons 868 lbs. per acre.

INDIAN CORN—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Thoroughbred White Flint	23	176	30	1600	10	Selected Leaming	17	1706	24	1830
2	Salzer's All Gold	20	304	27	670	11	Compton's Early	17	1068	22	1320
3	Red Cob Ensilage	20	128	28	1200	12	Mammoth Cuban	17	980	22	770
4	Giant Prolific Ensilage	19	1094	24	950	13	Evergreen Sugar	17	430	23	1850
5	Early Mastodon	19	170	25	1700	14	Cloud's Early Yellow	17	354	24	70
6	Longfellow	18	1902	26	20	15	Angel of Midnight	16	1962	22	1460
7	Pride of the North	18	1710	27	450	16	White Cap Yellow Dent	16	956	18	1400
8	Superior Fodder	18	894	22	550	17	Champion White Pearl	16	934	20	150
9	Early Butler	18	520	23	1520	18	North Dakota White	15	1130	22	1100

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (4 years)	21	1780	29	850	King Philip (4 years)	18	135	22	770

The average crop of the twenty varieties of Indian corn tested on the Experimental Farm at Nappan in 1905 was 24 tons 1011 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Thoroughbred White Flint	22	1,646	19	808	10	Early Butler	18	1,118	22	1,408
2	Superior Fodder	20	1,105	23	464	11	Pride of the North	18	643	23	200
3	Longfellow	20	207	29	80	12	Giant Prolific Ensilage	18	326	15	1,680
4	Salzer's All Gold	19	1,442	21	240	13	Early Mastodon	17	426	15	1,680
5	Champion White Pearl	19	570	13	1,720	14	Mammoth Cuban	17	109	11	1,760
6	North Dakota White	19	438	22	880	15	White Cap Yellow Dent	16	1,686	13	1,720
7	Compton's Early	18	1,990	25	160	16	Selected Leaming	16	578	19	280
8	Angel of Midnight	18	1,541	25	1,744	17	Cloud's Early Yellow	15	1,126	13	1,720
9	Red Cob Ensilage	18	1,382	19	1,600	18	Evergreen Sugar	14	538	11	1,760

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (4 years)	21	37	23	1,520	King Philip (4 years)	18	828	18	960

The average crop of the twenty varieties of Indian corn tested on the Experimental Farm at Brandon in 1905 was 19 tons, 1,019 lbs. per acre.

INDIAN CORN—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Angel of Midnight....	17	1,526	13	950	10	Champion White Pearl	14	937	14	50
2	Salzer's All Gold.....	17	1,486	16	1,550	11	Red Cob Ensilage.....	14	772	18	850
3	Pride of the North....	16	842	19	500	12	White Cap Yellow Dent.....	14	565	14	600
4	Throughbred White Flint.....	16	652	17	650	13	Early Mastodon	13	1,896	13	400
5	Compton's Early.....	16	503	17	650	14	Mammoth Cuban.....	13	1,594	14	600
6	North Dakota White..	15	1,368	15	1,350	15	Early Butler.....	13	1,572	11	1,100
7	Giant Prolific Ensilage	15	690	14	50	16	Selected Leaming.....	13	770	18	300
8	Superior Fodder.....	15	510	19	1,600	17	Evergreen Sugar	13	259	12	1,850
9	Longfellow..... .. .	14	1,273	13	1,500	18	Cloud's Early Yellow..	12	655	11	..

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (4 years).....	15	481	19	1,600	King Philip (4 years).....	14	655	13	400

The average crop of the twenty varieties of Indian corn tested on the Experimental Farm at Indian Head in 1905 was 15 tons, 828 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM AT AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Thoroughbred White Flint.....	23	1,542	22	1,210	10	Early Butler.....	18	960	20	700
2	Pride of the North....	21	1,976	29	1,620	11	Champion White Pearl	18	256	19	940
3	Red Cob Ensilage.....	20	1,558	19	1,600	12	White Cap Yellow Dent.....	17	628	22	880
4	Superior Fodder.....	20	504	19	720	13	Angel of Midnight....	16	692	13	840
5	Mammoth Cuban.	20	18	21	1,560	14	North Dakota White..	16	692	18	80
6	Salzer's All Gold.....	19	1,622	17	1,860	15	Longfellow	15	778	18	960
7	Compton's Early.. ...	19	1,604	18	1,620	16	Selected Leaming....	15	316	13	1,060
8	Giant Prolific Ensilage	19	566	22	440	17	Cloud's Early Yellow..	15	304	14	160
9	Early Mastodon.....	18	1,510	16	1,000	18	Evergreen Sugar.....	12	1,612	12	220

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Eureka (4 years).....	16	1,440	15	1,900	King Philip (4 years).....	16	670	16	780

The average crop of the twenty varieties of Indian corn tested on the Experimental Farm at Agassiz, in 1905 was 18 tons, 1,307 lbs. per acre.

FIELD ROOTS.

In the previous issues of this Annual Crop Bulletin the results have been given of two sowings of roots at each farm, the second sowing having always been made about two weeks later than the first. Except in a few cases (chiefly at Indian Head where the young plants of the first sowing have been injured by unfavourable weather or by destructive insects) a considerably greater yield has almost invariably been obtained from the plots earliest sown. This applies to all the kinds of field roots here reported upon. In turnips and mangels the gain from early sowing, taking the average of all the experimental farms for the five years ending 1904, was more than five tons per acre; while in carrots it was more than three tons and in sugar beets nearly three tons per acre. On the experimental farms at Ottawa and Nappan the average gains from early sowing have in most instances been considerably greater than those just mentioned.

The increased yields obtained by early sowing having been so fully demonstrated it has been thought unnecessary to continue the publication in this bulletin of the returns from the second sowings. They will be found in the annual report of the Experimental Farms.

TURNIPS.

Twenty varieties were tested in 1905, sown in drills, or on the flat, 2½ feet apart. The dates of sowing were as follows:—Ottawa, Ont., May 10; Nappan, N.S., May 25; Brandon, Man., May 20; Indian Head, Sask., May 17; and at Agassiz, B.C., May 15

The dates of pulling were as follows:—Ottawa, Oct. 25; Nappan, Oct. 16; Brandon, Oct. 14, Indian Head, Oct. 23; and at Agassiz, Oct. 30.

In Canada the ton is 2,000 lbs.

AVERAGE YIELD AT ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average yield for 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average yield for 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede.....	32	1569	30	1609	10	Mammoth Clyde.....	30	1612	27	409
2	Magnum Bonum.....	32	942	30	417	11	Kangaroo.....	30	1534	26	1298
3	Hall's Westbury.....	32	290	29	2	12	Elephant's Master....	30	1327	26	1363
4	Carter's Elephant.....	31	1716	31	533	13	Skirvings.....	30	1208	28	528
5	Halewood's Bronze Top	31	1398	29	252	14	Bangholm Selected....	30	981	28	1113
6	Emperor Swede.....	31	1071	29	958	15	Drummond Purple Top	30	623	24	1760
7	Jumbo.....	31	931	28	1105	16	Selected Purple Top..	29	1972	27	1522
8	Imperial Swede.....	31	93	27	71	17	East Lothian.....	29	1537	26	1203
9	Hartley's Bronze.....	30	1719	28	1923	18	Sutton's Champion...	29	1516	29	304

Varieties tested for less than five years.	Average yield for less than five years.		Average yield for 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average yield for 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Good Luck (4 years).....	32	1522	29	636	New Century (4 years)...	30	499	28	901

The average yield of the twenty varieties of turnips tested on all the Experimental Farms in 1905, was 28 tons, 795 lbs. per acre.

TURNIPS—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Emperor Swede.....	37	1,912	32	1,400	10	Hartley's Bronze.....	34	1,209	32	1,300
2	Jumbo.....	37	1,777	34	1,100	11	Imperial Swede.....	34	739	23	200
3	Kangaroo	37	1,536	34	800	12	Carter's Elephant.....	34	535	30	1,600
4	Magnum Bonum.....	36	1,523	31	500	13	Perfection Swede.....	34	422	36	500
5	Mammoth Clyde.....	36	197	33	1,700	14	East Lothian.....	33	731	27	1,300
6	Halewood's BronzeTop	36	27	29	600	15	Selected Purple Top...	32	1,988	30	1,900
7	Drummond Purple Top	35	680	24	400	16	Bangholm Selected....	32	971	26	1,100
8	Hall's Westbury.....	35	205	27	1,100	17	Skirvings.....	31	1,878	28	1,700
9	Elephant's Master	34	1,748	29	1,000	18	Sutton's Champion....	31	1,533	31	1,400

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs,
Good Luck (4 years).....	39	1,481	29	1,700	New Century (4 years)...	39	1,350	34	1,900

The average yield of the twenty varieties of turnips tested on the Central Experimental Farm at Ottawa in 1905 was 30 tons, 1,060 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Vaaieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede.....	43	560	41	688	10	Elephant's Master	39	270	35	1,592
2	Hartley's Bronze.....	41	1,163	40	1,624	11	Imperial Swede....	39	62	35	376
3	Carter's Elephant.....	41	579	40	256	12	Jumbo..	38	1,836	38	1,824
4	Magnum Bonum.....	41	310	43	994	13	Drummond Purple Top	38	1,818	39	888
5	Selected Purple Top...	40	102	39	432	14	Bangholm Selected....	38	1,698	37	328
6	Kangaroo.....	39	1,884	35	1,896	15	Hall's Westbury.....	38	978	37	1,848
7	Mammoth Clyde.....	39	641	35	1,288	16	Sutton's Champion....	37	1,324	34	400
8	Emperor Swede.	39	423	41	80	17	Skirvings..	37	411	39	1,344
9	Halewood's BronzeTop	39	351	35	832	18	East Lothian.....	36	345	39	584

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Good Luck (4 years).....	42	357	39	1,040	New Century (4 years)...	37	466	34	1,008

The average yield of the twenty varieties of turnips tested on the Experimental Farm at Nappan in 1905 was 38 tons, 466 lbs. per acre.

TURNIPS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons,	Lbs.	Tons.	Lbs.
1	Magnum Bonum.....	29	1,664	26	8	10	Elephant's Master	26	1,962	29	344
2	Hall's Westbury.....	29	238	27	1,440	11	Imperial Swede.	26	1,750	30	456
3	Bangholm Selected....	28	971	33	792	12	Mammoth Clyde... .	26	1,381	26	1,328
4	Skirvings.....	28	390	25	1,744	13	Kangaroo.	26	430	18	1,224
5	Sutton's Champion....	28	285	30	1,248	14	Halewood's Bronze Top	26	378	27	912
6	Hartley's Bronze	27	1,176	29	1,928	15	East Lothian.....	26	325	25	160
7	Perfection Swede.	27	806	29	872	16	Drummond Purple Top	25	1,955	26	536
8	Jumbo.....	27	14	25	688	17	Selected Purple Top ..	24	1,474	24	48
9	Carter's Elephant.....	27	13	30	984	18	Emperor Swede.....	24	1,104	29	80

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Good Luck (4 years).....	32	350	29	1,400	New Century (4 years)...	28	100	30	192

The average yield of the twenty varieties of turnips tested on the Experimental Farm at Brandon in 1905 was 27 tons, 1,519 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede	27	3	31	436	10	Jumbo..... ..	22	1,601	26	1,196
2	Halewood's Bronze Top	26	774	38	1,484	11	Hartley's Bronze.....	22	1,591	21	1,956
3	Hall's Westbury...	25	1,853	32	1,868	12	Carter's Elephant....	22	1,063	34	1,168
4	Skirvings..... .	24	1,442	30	1,776	13	Bangholm Selected....	22	609	29	1,664
5	Sutton's Champion....	24	326	33	1,980	14	Drummond Purple Top	21	1,794	22	748
6	Emperor Swede.....	23	1,954	30	720	15	Mammoth Clyde.....	21	1,326	21	240
7	Selected Purple Top ..	23	1,921	25	1,876	16	Kangaroo.....	20	1,583	27	1,836
8	Imperial Swede. . ..	23	1,299	28	1,288	17	Elephant's Master	20	1,531	22	1,804
9	Magnum Bonum.....	23	821	29	1,400	18	East Lothian.....	20	36	23	860

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Good Luck (4 years)....	22	979	31	1,228	New Century (4 years)...	21	66	25	820

The average yield of the twenty varieties of turnips tested on the Experimental Farm at Indian Head in 1905, was 28 tons, 1,017 lbs. per acre.

TURNIPS—*Concluded.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Carter's Elephant.....	34	389	20	656	11	Jumbo.....	30	1,426	17	716
2	East Lothian.....	33	220	17	1,112	12	Bangholm Selected ...	30	654	15	1,680
3	Elephant's Master....	32	1,122	16	76	13	Mammoth Clyde.....	30	516	18	1,488
4	Hall's Westbury.....	32	178	18	1,752	14	Drummond Purple Top.....	29	867	12	228
5	Perfection Swede.....	32	54	15	1,548	15	Kangaroo	29	235	16	736
6	Emperor Swede.....	31	1,960	14	512	16	Selected Purple Top..	28	377	18	1,356
7	Imperial Swede.....	31	614	18	36	17	Hartley's Bronze	27	1,458	19	808
8	Magnum Bonum.....	31	390	20	1,184	18	Sutton's Champion....	27	113	15	492
9	Skirvings.....	30	1,919	16	76						
10	Halewood's Bronze Top.	30	1,461	14	1,430						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Good Luck (4 years).....	27	442	15	1,812	New Century (4 years)...	25	515	17	584

The average yield of the twenty varieties of turnips tested on the Experimental Farm at Agassiz in 1905, was 16 tons, 1,914 lbs. per acre.

MANGELS.

Sixteen varieties of mangels have been under test during 1905. All were sown in drills or on the flat in rows 2½ feet apart. The dates of sowing were as follows:—At Ottawa, Ont., May 10; Nappan, N.S., May 25; Brandon, Man., May 20; Indian Head, Sask., May 13, and at Agassiz, B.C., April 12.

The dates of pulling were as follows:—At Ottawa, Ont., October 25; Nappan, N.S., October 12; Brandon, Man., October 4; Indian Head, Sask., October 9, and at Agassiz, B.C., October 27.

In Canada the ton is 2,000 lbs.

MANGELS—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average yield for 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average yield for 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Half Long Sugar White	32	295	33	974	7	Prize Winner Yellow Globe	30	709	32	804
2	Mammoth Yellow Intermediate	31	1,952	31	1,487	8	Prize Mammoth Long Red	30	317	34	1,481
3	Mammoth Long Red	31	1,433	28	1,978	9	Giant Yellow Globe	29	833	30	1,046
4	Lion Yellow Intermediate	31	155	32	848	10	Selected Mammoth Long Red	28	1,542	28	241
5	Yellow Intermediate	30	1,865	30	1,548	11	Triumph Yellow Globe	28	1,349	28	18
6	Giant Yellow Intermediate	30	1,000	30	1,723	12	Half Long Sugar Rosy	28	945	24	1,066
						13	Gate Post	28	850	27	1,636
						14	Leviathan Long Red	26	1,798	28	1,716

Varieties tested for less than five years.	Average yield for less than five years.		Average yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Selected Yellow Globe (4 years)	30	432	31	528	Giant Sugar (4 years)	28	1,042	30	819

The average yield of the 16 varieties of mangels tested on all the Experimental Farms in 1905 was 30 tons, 620 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Yield for 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Mammoth Yellow Intermediate	42	140	45	950	7	Yellow Intermediate	37	1,491	35	1,300
2	Mammoth Long Red	41	557	37	700	8	Triumph Yellow Globe	37	334	29	500
3	Half Long Sugar White	40	1,326	52	600	9	Gate Post	35	1,090	35	....
4	Prize Winner Yellow Globe	39	1,007	45	200	10	Giant Yellow Intermediate	35	568	40	1,250
5	Prize Mammoth Long Red	39	187	46	700	11	Leviathan Long Red	35	20	40	1,400
6	Lion Yellow Intermediate	37	1,742	39	600	12	Giant Yellow Globe	34	1,179	37	800
						13	Half Long Sugar Rosy	34	74	36	....
						14	Selected Mammoth Long Red	32	372	28	1,200

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Giant Sugar Mangel (4 years)	35	839	40	900	Selected Yellow Globe (4 years)	35	345	37	800

The average yield of the sixteen varieties of mangels tested on the Central Experimental Farm at Ottawa in 1905 was 39 tons 369 lbs. per acre.

MANGELS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Mammoth Yellow Intermediate	38	1,313	31	1,992	7	Giant Yellow Globe	34	309	29	1,888
2	Lion Yellow Intermediate	38	208	30	1,104	8	Half Long Sugar Rosy	33	473	27	1,328
3	Giant Yellow Intermediate	36	751	30	648	9	Prize Mammoth Long Red	33	279	31	776
4	Yellow Intermediate	36	64	28	392	10	Gate Post	32	300	23	1272
5	Prize Winner Yellow Globe	35	526	27	1,632	11	Selected Mammoth Long Red	31	627	27	416
6	Half Long Sugar White	34	1,630	31	1,688	12	Mammoth Long Red	31	449	24	1,400
						13	Leviathan Long Red	30	1,452	24	1,704
						14	Triumph Yellow Globe	30	178	26	896

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Selected Yellow Globe (4 years)	35	1,670	28	1.000	Giant Sugar Mangel (4 years)	31	333	24	32

The average yield of the sixteen varieties of mangels tested on the Experimental Farm at Nappan in 1905 was 28 tons 135 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Mammoth Long Red	32	1,102	38	560	8	Triumph Yellow Globe	27	1,915	33	792
2	Half Long Sugar White	32	522	30	720	9	Half Long Sugar Rosy	37	833	34	640
3	Selected Mamm. Long Red	30	1,566	38	1,880	10	Giant Yellow Intermediate	26	1,090	30	720
4	Yellow Intermediate	29	1,347	37	976	11	Lion Yellow Intermediate	36	272	35	224
5	Prize Mammoth Long Red	29	450	42	744	12	Prize Winner Yellow Globe	25	1,451	36	192
6	Mamm. Yellow Intermediate	28	285	31	40	13	Giant Yellow Globe	25	1,427	33	..
7	Gate Post	28	21	33	1,848	14	Leviathan Long Red	25	288	29	1,136

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Selected Yellow Globe (4 yrs.)	25	622	32	944	Giant Sugar Mangel (4 yrs.)	23	1,718	29	80

The average yield of the sixteen varieties of mangels on the Experimental Farm at Brandon in 1905 was 34 tons 218 lbs. per acre.

MANGELS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Prize Winner Yellow Globe	26	1,311	40	124	8	Giant Yellow Globe	23	986	31	964
2	Giant Yellow Intermediate	25	1,338	34	244	9	Lion Yellow Intermediate	23	556	33	396
3	Triumph Yellow Globe	25	664	37	1,240	10	Half Long Sugar Rosy	22	1,900	28	628
4	Mamm. Yellow Intermediate	24	1,876	34	1,828	11	Selected Mamm. Long Red	22	1,456	27	120
5	Half Long Sugar White	24	1,205	33	1,980	12	Gate Post	21	1,538	25	1,348
6	Yellow Intermediate	23	1,516	33	1,452	13	Mammoth Long Red	21	818	32	238
7	Prize Mamm. Long Red	23	1,484	29	1,004	14	Leviathan Long Red	21	648	26	404

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Selected Yellow Globe (4 yrs.)	24	1,845	34	1,960	Giant Sugar Mangel (4 yrs.)	21	1,316	32	284

The average yield of the sixteen varieties of mangels on the Experimental Farm at Indian Head in 1905 was 32 tons 388 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons,	Lbs.
1	Mammoth Long Red	32	238	16	76	8	Mamm. Yellow Intermediate	28	147	15	624
2	Lion Yellow Intermediate	29	1,996	23	1,916	9	Prize Mamm. Long Red	25	1,187	24	180
3	Giant Yellow Globe	29	265	20	1,580	10	Half Long Sugar Rosy	24	1,445	16	736
4	Giant Yellow Intermediate	28	1,251	18	1,752	11	Gate Post	24	1,302	20	1,712
5	Half Long Sugar White	28	793	18	1,884	12	Prize Winner Yellow Globe	24	1,250	12	1,872
6	Yellow Intermediate	27	905	18	1,620	13	Triumph Yellow Globe	22	1,654	13	664
7	Selected Mamm. Long Red	26	1,691	18	1,588	14	Leviathan Long Red	22	583	22	1,934

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
Giant Sugar Mangel (4 yrs.)	30	1,006	26	800	Selected Yellow Globe (4 yrs.)	29	1,680	22	1,936

The average yield of the sixteen varieties of mangels on the Experimental Farm at Agassiz in 1905 was 19 tons 930 lbs. per acre.

CARROTS.

Ten different sorts of carrots were tested during 1905, all being sown in drills or on the flat in rows two feet apart. The dates of sowing were as follows:—At Ottawa, Ont., May 10; Nappan, N.S., May 25; Brandon, Man., May 20; Indian Head, Sask., April 19; and Agassiz, B.C., April 12.

The dates of pulling were as follows:—At Ottawa, October 25; Nappan, October 17; Brandon, October 4; Indian Head, October 23; and at Agassiz, October 27.

In Canada the ton is 2,000 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Giant White Vosges...	23	1,969	24	484	6	White Belgian.....	20	642	20	1,103
2	New White Intermediate.....	23	1,594	25	584	7	Carter's Orange Giant.	19	1,438	22	1,062
3	Ontario Champion.....	23	1,177	24	1,964	8	Long Yellow Stump Rooted.....	19	566	18	1,851
4	Mammoth White Intermediate.....	23	219	24	1,988	9	Half Long Chantenay.	18	55	14	1,361
5	Improved Short White.	22	1,587	25	832	10	Early Gem.....	17	1,390	21	310

The average yield of the ten varieties of carrots on all the Experimental Farms in 1905 was 22 tons. 556 lbs. per acre.

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Mammoth White Intermediate.....	32	1,139	32	500	6	Carter's Orange Giant.	25	1,745	24	600
2	New White Intermediate.....	32	905	30	1,600	7	Long Yellow Stump Rooted.....	24	1,906	21	600
3	Giant White Vosges...	31	379	30	600	8	Half Long Chantenay.	24	1,101	14	200
4	Ontario Champion....	29	1,448	28	1,000	9	White Belgian.....	21	1,963	21	1,100
5	Improved Short White	29	1,068	30	1,700	10	Early Gem.....	20	1,747	23	1,200

The average yield of the ten varieties of carrots on the Central Experimental Farm at Ottawa in 1905 was 25 tons. 1,510 lbs. per acre.

CARROTS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Mammoth White Intermediate	23	1,507	18	1,392	6	Improved Short White.	21	179	19	304
2	Giant White Vosges	23	1,472	18	1,544	7	Long Yellow Stump Rooted	20	1,348	17	808
3	Ontario Champion	23	937	18	24	8	Half Long Chantenay.	19	1,279	17	200
4	New White Intermediate	22	428	19	....	9	Early Gem	18	1,393	17	504
5	White Belgian	21	865	18	784	10	Carter's Orange Giant.	18	686	18	1,240

The average yield of the ten varieties of carrots on the Experimental Farm at Nappan in 1905 was 18 tons. 480 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	New White Intermed.	24	1,104	27	120	7	Mammoth White Intermediate	17	1,772	27	1,880
2	Ontario Champion	23	1,168	26	1,240	8	Carter's Orange Giant.	17	1,036	25	600
3	Improved Short White.	22	528	32	1,120	9	Early Gem	14	1,128	23	1,080
4	Giant White Vosges	20	1,624	31	1,360	10	Half Long Chantenay.	14	776	10	1,120
5	White Belgian	20	920	21	1,560						
6	Long Yellow Stump Rooted	18	124	19	720						

The average yield of the ten varieties of carrots on the Experimental Farm at Brandon in 1905 was 24 tons, 1,280 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Ontario Champion	16	113	25	1,744	7	Half Long Chantenay.	12	1,730	13	1,984
2	New White Intermediate	15	1,562	24	1,368	8	Mammoth White Intermediate	12	1,694	17	584
3	Giant White Vosges	14	1,464	21	1,296	9	Carter's Orange Giant.	12	749	20	1,448
4	Improved Short White	14	402	16	1,264	10	Long Yellow Stump Rooted.	12	274	10	1,648
5	White Belgian	13	426	18	36						
6	Early Gem	13	47	17	1,904						

The average yield of the ten varieties of carrots on the Experimental Farm at Indian Head in 1905 was 18 tons, 1,527 lbs. per acre.

CARROTS—*Concluded.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905,	
		Tons.	Lbs	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Giant White Vosges ..	29	905	18	1,620	7	New White Intermediate	23	1,972	24	1,830
2	Mammoth White Intermediate.....	28	982	28	1,585	8	Early Gem.....	21	636	23	860
3	Improved Short White	26	1,756	27	1,770	9	Long Yellow Stump Rooted.	20	1,184	25	1,480
4	Ontario Champion	25	217	25	1,810	10	Half Long Chantenay.	18	1,387	17	1,300
5	White Belgian	24	1,038	23	35						
6	Carter's Orange Giant.	24	972	23	1,520						

The average yield of the ten varieties of carrots on the Experimental Farm at Agassiz in 1905 was 23 tons, 1,981 lbs. per acre.

SUGAR BEETS.

Eight varieties of sugar beets have been tested during 1905, sown in drills or on the flat in rows two feet apart. The dates of sowing were:—At Ottawa, Ont., May 10; Nappan, N.S., May 25; Brandon, Man., May 20; Indian Head, Sask., May 13; and at Agassiz, B.C., April 12.

The dates of pulling were as follows:—At Ottawa, Oct. 25; Nappan, Oct. 13; Brandon, Oct. 4; Indian Head, Oct. 21; and at Agassiz, Oct. 30.

The yield per acre in each instance has been calculated from the weight of roots gathered from two rows each 66 feet long. Though all the varieties included in these tests are commonly classed as sugar beets, it should be noted that the only sorts recommended for use in the manufacture of beet sugar are Wanzleben, Vilmorin's Improved, and French Very Rich.

In Canada the ton. is 2,000 lbs.

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Red Top Sugar.....	26	1,573	32	363	5	Improved Imperial....	24	455	25	877
2	Royal Giant.....	26	35	27	1,729	6	Wanzleben	20	1,546	20	1,443
3	Danish Red Top.....	25	1,432	27	958	7	Vilmorin's Improved..	19	358	19	1,745
4	Danish Improved.....	24	1,513	25	78						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.		Tons.	Lbs.	Tons.	Lbs.
French Very Rich (4 yrs.)	18	359	18	1,077	.....	.....		.....	

The average yield of the eight varieties of sugar beets on all the Experimental Farms in 1905 was 24 tons. 1,284 lbs. per acre.

SUGAR BEETS—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Red Top Sugar.....	35	69	36	900	5	Royal Giant.....	30	1,286	29	600
2	Danish Red Top.....	34	581	50	1,300	6	Wanzleben.....	26	145	25	600
3	Danish Improved.....	33	1,868	38	1,900	7	Vilmorin's Improved..	23	269	26	900
4	Improved Imperial....	31	108	32	1,600						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.
French Very Rich (4 years).....	23	737	28	..

The average yield of the eight varieties of sugar beets on the Central Experimental Farm at Ottawa in 1905 was 32 tons. 475 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Royal Giant.	30	1,261	27	1,176	5	Danish Improved.....	26	219	23	824
2	Red Top Sugar.....	28	957	28	1,912	6	Wanzleben.....	23	1,011	16	1,592
3	Improved Imperial....	27	908	24	336	7	Vilmorin's Improved..	21	691	16	1,440
4	Danish Red Top.....	27	597	28	1,000						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.
French Very Rich (4 years)...	18	400	14	120

The average yield of the eight varieties of sugar beets on the Experimental Farm at Nappan in 1905 was 22 tons, 1,050 lbs. per acre.

SUGAR BEETS—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Red Top Sugar.....	28	1,763	52	544	5	Royal Giant.....	21	240	33	528
2	Danish Red Top.....	26	879	46	400	6	Improved Imperial....	20	814	33	..
3	Danish Improved.....	22	1,883	28	1,024	7	Vilmorin's Improved..	16	683	24	576
4	Wanzleben.....	21	979	32	680						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.
French Very Rich (4 years).....	16	340	21	240

The yield of the eight varieties of sugar beets on the Experimental Farm at Brandon in 1905, was 33 tons, 1749 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Royal Giant	22	310	27	252	5	Danish Improved.....	17	735	22	616
2	Red Top Sugar	20	1,140	27	384	6	Vilmorin's Improved..	14	1,525	16	1,396
3	Improved Imperial....	19	382	19	1,600	7	Wanzleben	14	398	15	1,416
4	Danish Red Top.....	17	800	12	1,872						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.
French Very Rich (4 years).....	13	1301	15	888

The average yield of the eight varieties of sugar beets on the Experimental Farm at Indian Head in 1905 was 19 tons, 1303 lbs per acre.

SUGAR BEETS—*Concluded.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Tons.	Lbs.	Tons.	Lbs.			Tons.	Lbs.	Tons.	Lbs.
1	Royal Giant.	25	1,076	22	88	5	Red Top Sugar	20	1,938	16	76
2	Danish Improved.....	23	858	12	24	6	Vilmorin's Improved..	20	622	15	412
3	Danish Red Top.....	23	301	9	216	7	Wanzleben	18	1,198	13	928
4	Improved Imperial....	23	64	17	848						

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Tons.	Lbs.	Tons.	Lbs.
French Very Rich (4 years).....	19	1,017	13	136

The average yield of the eight varieties of sugar beets on the Experimental Farm at Agassiz in 1905, was 14 tons, 1591 lbs. per acre.

POTATOES.

Forty varieties of potatoes have been under test during 1905. The potatoes were cut into pieces with two or three eyes in each, and these pieces were planted in rows 2½ feet apart, the sets being placed a foot apart in the rows. The dates of planting and digging were as follows:—At Ottawa, Ont., planted May 22, dug October 5; at Nappan, N.S., planted May 31, dug October 3 and 4; at Brandon, Man., planted May 16, dug October 2; at Indian Head, Sask., planted May 13, dug October 3; and at Agassiz, B.C., planted April 29, dug September 22.

In Canada the bushel of potatoes is 60 lbs.

POTATOES—*Continued.*

AVERAGE YIELD ON ALL THE EXPERIMENTAL FARMS.

Number.	Varieties tested for five years.	Average yield for five years.		Average yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Average yield in 1905.	
		Bush.	Lbs.	Bush.	Lbs.			Bush.	Lbs.	Bush.	Lbs.
1	Late Puritan	451	53	512	34	18	Canadian Beauty	407	57	434	50
2	Rose No. 9	436	52	468	34	19	Delaware	404	41	459	11
3	Uncle Sam	436	6	488	49	20	Reeves' Rose	398	31	469	10
4	Seedling No. 7	430	49	487	56	21	Penn Manor	394	16	438	13
5	Enormous	429	53	469	18	22	Vick's Extra Early	393	39	439	50
6	Carman No. 1	428	23	450	6	23	Rochester Rose	393	34	387	46
7	American Wonder	423	22	532	40	24	Irish Cobbler	388	32	406	58
8	Country Gentleman	421	55	500	33	25	Swiss Snowflake	387	52	383	30
9	Money Maker	420	16	457	30	26	Maule's Thoroughbred	387	43	471	4
10	Sabean's Elephant	420	5	479	52	27	Cambridge Russet	387	25	393	55
11	Burnaby Mammoth	418	31	420	54	28	Carman No. 3	379	53	448	14
12	Dreer's Standard	418	28	513	45	29	Everett	376	2	364	10
13	State of Maine	417	26	467	6	30	Early St. George	372	37	427	30
14	Holborn Abundance	417	3	477	40	31	Early White Prize	344	56	412	15
15	American Giant	416	25	475	44	32	Bovee	334	37	385	51
16	I. X. L.	415	41	469	10	33	Early Rose	329	3	346	15
17	Empire State	408	37	520	12	34	Early Andes	297	29	341	25

Varieties tested for less than five years.	Average yield for less than five years.		Average yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Average yield in 1905.	
	Bush.	Lbs.	Bush.	Lbs.		Bush.	Lbs.	Bush.	Lbs.
Pearce (3 years)	425	46	458	1	Vermont Gold Coin (1 yr)	534	26	534	26
Early Envoy (3 years)	311	22	328	13	Morgan Seedling (1 year)	508	10	508	10
Pingree (3 years)	272	45	302	33	Dooley (1 year)	436	45	436	45

The average crop of the forty varieties of potatoes on all the Experimental Farms in 1905 was 444 bushels, 16 lbs. per acre.

POTATOES—*Continued.*

AVERAGE YIELD ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Bush.	Lbs.	Bush.	Lbs.			Bush.	Lbs.	Bush.	Lbs.
1	Late Puritan	452	46	330	..	18	Everett	369	36	290	24
2	Carman No. 1	447	55	321	12	19	Country Gentleman	367	50	382	48
3	Money Maker	439	7	299	12	20	American Wonder	362	7	369	36
4	Dreer's Standard	434	17	334	24	21	Rose No. 9	359	55	294	48
5	Burnaby Mammoth	427	41	316	48	22	Delaware	359	29	356	24
6	I. X. L.	422	50	396	..	23	Swiss Snowflake	359	29	286	..
7	Canadian Beauty	422	24	396	..	24	Penn Manor	349	48	281	36
8	Sabean's Elephant	418	00	404	48	25	Seedling No. 7	343	12	365	12
9	Uncle Sam	390	43	321	12	26	Empire State	332	12	369	36
10	Holborn Abundance	389	50	360	48	27	Maule's Troroughbred	331	46	396	..
11	Rochester Rose	385	26	352	..	28	Early Rose	321	12	294	48
12	Enormous	383	41	343	12	29	Carman No. 3	315	29	277	12
13	Irish Cobbler	383	41	290	24	30	Cambridge Russet	309	19	228	48
14	Vick's Extra Early	383	41	338	48	31	Early St. George	286	53	198	..
15	American Giant	381	29	281	36	32	Early White Prize	279	24	272	48
16	Reeves' Rose	378	51	343	12	33	Bovee	253	53	250	48
17	State of Maine	371	48	316	48	34	Early Andes	214	46	246	24

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Bush.	Lbs.	Bush.	Lbs.		Bush.	Lbs.	Bush.	Lbs.
Pearce (3 years)	367	..	391	36	Morgan Seedling (1 year)	374	..	374	..
Early Envoy (3 years)	231	..	162	48	Dooley (1 year)	356	24	356	24
Pingree (3 years	198	44	268	24	Vermont Gold Coin (1 yr)	347	36	347	36

The average crop of the forty varieties of potatoes on the Central Experimental Farm for 1905 was 320 bushels, 13 lbs. per acre.

POTATOES—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Bus.	Lbs.	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	Vick's Extra Early....	446	10	424	36	18	State of Maine.....	329	34	321	12
2	Enormous.....	410	5	345	24	19	Swiss Snowflake.....	328	41	327	48
3	Rose No. 9.....	407	26	345	24	20	Early White Prize....	325	36	345	24
4	Seedling No. 7.....	391	10	288	12	21	Carman No. 3.....	324	43	319	..
5	Rochester Rose..	387	34	325	36	22	Maule's Thoroughbred.	322	58	301	24
6	Canadian Beauty.....	373	34	319	..	23	Dreer's Standard.....	321	12	264	..
7	Late Puritan.	370	29	360	48	24	Sabean's Elephant	319	..	275	..
8	Holborn Abundance...	370	2	477	24	25	Uncle Sam.....	315	29	270	36
9	Everett..	368	46	268	24	26	Cambridge Russet.....	314	36	266	12
10	Penn. Manor.....	368	43	325	36	27	Country Gentleman...	310	38	327	48
11	I. X. L	357	43	418	..	28	Early St. George... ..	308	7	233	12
12	Irish Cobbler.....	356	12	308	..	29	American Giant.....	302	43	301	24
13	Delaware.....	341	52	352	..	30	Bovee.....	302	17	257	24
14	Money Maker.....	341	38	387	12	31	American Wonder	296	7	407	..
15	Burnaby Mammoth. ..	340	34	272	48	32	Early Andes	280	17	217	48
16	Carman No. 1..... ..	336	10	354	12	33	Reeve's Rose.....	267	31	222	12
17	Empire State.....	333	5	407	..	34	Early Rose.....	252	34	244	12

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Pearce (3 years).....	456	8	338	48	Vermont Gold Coin (1 yr).	512	36	512	36
Pingree (3 years).....	343	12	330	..	Morgan Seedling (1 year).	484	.	484	..
Early Envoy (3 years)....	330	44	233	12	Dooley (1 year).	413	36	413	36

The average crop of the forty varieties of potatoes on the Experimental Farm at Nappan for 1905 was 329 bushels 50 lbs. per acre.

POTATOES—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Bus.	Lbs.	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	American Wonder....	566	8	799	20	18	Seedling No. 7.....	492	48	520	40
2	Enormous.....	565	24	722	20	19	I. X. L.....	489	8	561	..
3	State of Maine.....	552	12	755	20	20	Reeve's Rose..... ...	487	40	726	..
4	Dreer's Standard.....	548	20	887	20	21	Holborn Abundance ..	478	52	700	20
5	Late Puritan.....	544	30	652	40	22	Irish Cobbler.....	478	8	575	40
6	Money Maker.....	536	48	718	40	23	Carman No. 3.....	462	..	605	..
7	Sabean's Elephant	529	28	744	20	24	Swiss Snowflake....	454	40	656	20
8	Empire State.....	528	..	704	..	25	Carman No. 1..... ...	450	16	564	40
9	Maule's Thoroughbred.	526	32	689	20	26	Penn. Manor.....	450	16	663	40
10	Uncle Sam	525	48	762	40	27	Early White Prize....	434	52	586	40
11	Country Gentleman...	525	48	788	20	28	Early St. George.....	431	56	678	20
12	Delaware.....	523	36	689	20	29	Everett.....	418	..	531	40
13	Canadian Beauty.	517	..	759	..	30	Early Rose...	389	2	553	40
14	Rose No. 9.	514	48	696	40	31	Bovee.....	385	..	542	40
15	Cambridge Russet ...	505	16	605	..	32	Vick's Extra Early....	379	8	568	20
16	Burnaby Mammoth...	495	44	656	20	33	Rochester Rose.....	348	..	308	..
17	American Giant.....	494	16	638	..	34	Early Andes.....	329	16	454	40

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Pearce (3 years).....	534	7	685	40	Morgan Seedling (1 year).	.....		729	40
Early Envoy (3 years). ..	387	24	575	40	Vermont Gold Coin (1 yr)	.....		623	20
Pingree (3 years).....	267	40	348	20	Dooley (1 year).....	.....		403	20

The average crop of the forty varieties of potatoes on the Experimental Farm at Brandon for 1905 was 635 bushels, 48 lbs. per acre.

POTATOES—*Continued.*

AVERAGE YIELD ON THE EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Bus.	Lbs.	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	Carman No. 1	481	21	442	48	18	Empire State	409	49	447	12
2	American Giant	465	13	511	..	19	Rochester Rose	405	44	561	36
3	Uncle Sam	457	15	508	48	20	Reeves' Rose	405	33	530	48
4	Seedling No. 7	454	34	640	48	21	Money Maker	398	2	451	36
5	Country Gentleman	453	2	458	12	22	I. X. L	396	5	442	48
6	American Wonder	442	58	458	12	23	Swiss Snowflake	385	39	335	..
7	Rose No. 9	442	58	473	36	24	Canadian Beauty	384	6	348	12
8	Late Puritan	442	27	519	48	25	Everett	377	23	434	..
9	Burnaby Mammoth	442	16	484	36	26	Maule's Thoroughbred	376	50	484	36
10	Carman No. 3	437	5	525	12	27	Cambridge Russet	372	44	460	24
11	Penn. Manor	435	10	453	48	28	Irish Cobbler	372	25	337	12
12	Early St. George	425	34	491	12	29	Vick's Extra Early	361	44	462	36
13	Dreer's Standard	425	15	475	48	30	Enormous	648	54	379	..
14	Delaware	422	58	449	24	31	Early White Prize	345	11	394	24
15	State of Maine	422	52	418	36	32	Bovee	321	13	359	12
16	Holborn Abundance	416	23	392	12	33	Early Andes	319	36	392	12
17	Sabean's Elephant	413	53	491	12	34	Early Rose	309	30	308	36

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Early Envoy (3 years)	396	13	458	12	Vermont Gold Coin (1 yr.)	.....		625	24
Pearce (3 years)	359	49	398	48	Morgan Seedling (1 year)	.....		486	48
Pingree (3 years)	351	45	337	12	Dooley (1 year)	.....		354	48

The average crop of the forty varieties of potatoes on the Experimental Farm at Indian Head in 1905 was 449 bushels 39 lbs. per acre.

AVERAGE YIELD ON THE EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.		Number.	Varieties tested for five years.	Average yield for five years.		Yield in 1905.	
		Bus.	Lbs.	Bus.	Lbs.			Bus.	Lbs.	Bus.	Lbs.
1	Uncle Sam...	491	16	580	48	18	State of Maine.....	410	44	523	36
2	Seedling No. 7.....	472	20	624	48	19	Bovee	410	42	519	12
3	Rose No. 9	459	15	532	24	20	Early St. George.....	410	33	536	48
4	Reeves' Rose.....	452	59	523	36	21	Vick's Extra Early....	397	32	404	48
5	Country Gentleman...	452	19	545	36	22	Burnaby Mammoth...	386	18	374	..
6	Late Puritan.....	449	14	699	36	23	Money Maker.....	385	46	431	12
7	American Wonder....	447	46	629	12	24	Maule's Thoroughbred	380	31	484	..
8	Enormous.....	441	19	556	36	25	Delaware.....	375	32	448	48
9	Rochester Rose.....	441	6	391	36	26	Early Rose.....	372	59	330	..
10	Empire State.....	440	..	673	12	27	Penn. Manor.....	367	24	466	24
11	American Giant.....	438	26	646	40	28	Dreer's Standard	363	17	607	12
12	Cambridge Russet...	435	10	409	12	29	Carman No. 3..	360	8	514	48
13	Holborn Abundance...	430	6	457	36	30	Irish Cobbler.....	352	13	523	36
14	Carman No. 1	426	12	567	36	31	Everett	346	27	296	24
15	Sabean's Elephant	417	24	484	..	32	Early Andes.....	343	32	396	..
16	I. X. L..... ..	412	37	528	..	33	Canadian Beauty.....	342	39	352	..
17	Swiss Snowflake.....	410	50	312	24	34	Early White Prize....	339	38	462	..

Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.		Varieties tested for less than five years.	Average yield for less than five years.		Yield in 1905.	
	Bus.	Lbs.	Bus.	Lbs.		Bus.	Lbs.	Bus.	Lbs.
Pearce (3 yrs.).....	411	45	475	12	Dooley (1 yr.).....	.....		655	36
Early Envoy (3 yrs.).....	221	28	211	12	Vermont Gold Coin, (yr.).	.....		563	12
Pingree (3 yrs.).....	202	24	228	48	Morgan Seedling (1 yr.)..	.....		466	24

The average crop of the forty varieties of potatoes on the Experimental Farm at Agassiz for 1905 was 485 bushels, 51 lbs. per acre.

SUMMARY.

The results obtained from the uniform trial plots as given in this bulletin show that there are marked differences in the relative productiveness of varieties even when grown side by side under similar conditions. The results of the average crops obtained for five years indicate also that the tendency to productiveness is in many instances persistent, manifesting itself under varying conditions of soil and climate to a remarkable degree. The establishment of such facts points to the importance of farmers choosing for seed those varieties which give the heaviest crops, so that farming in Canada may thus be made more profitable.

During the past year the number of varieties under test has been further reduced by dropping some of those which have failed to come up to the high standard required. This reduction in the number tested will serve to give greater prominence to those varieties of the highest excellence.

ANNUAL DISTRIBUTION OF SAMPLES OF SEED GRAIN.

Provision has been made in connection with the annual distribution of samples for the improvement of seed to have available considerable quantities of the very best and most productive sorts, so that every farmer in Canada who applies in good season (before

March 1) may obtain a sample of such sort as he may desire; but only one sort can be sent to each applicant. Hence if an individual receives a sample of oats, he cannot also receive one of wheat, barley, Indian corn or potatoes, and applications for more than one sample for one household cannot be entertained. These samples are sent free by mail, in cotton bags, the spring wheat and barley in quantities of 5 lbs. each and oats in bags containing 4 lbs. each, enough in each case to sow one-twentieth of an acre. Instructions accompany each sample. In many instances the 5-lb. samples of wheat and barley have, when properly cared for, produced, by the end of the third season, from 100 to 200 bushels of grain, while in the case of oats such quantities have been available by the end of the second season, showing that with proper attention any farmer may soon provide himself with the best and most productive strains of seed in sufficient quantities to sow a large area, at no cost to himself beyond his own labour.

The distribution also includes samples of Indian corn (for ensilage purposes only) and potatoes. These latter samples weigh 3 lbs. each.

Among the principal varieties available for distribution are the following.

OATS.—Banner, Abundance, Wide Awake, Goldfinder, Thousand Dollar and Improved Ligowo. Goldfinder is a yellow oat. Black oats are not recommended for general cultivation and are only sent out when specially asked for. Improved Ligowo is earlier than the other varieties mentioned, but is less productive.

SPRING WHEAT.—Red Fife, (beardless) White Fife, (beardless) Preston, (bearded) Huron, (bearded) Stanley, (beardless) Percy (beardless) and Laurel, (beardless). Red and White Fife are varieties of the highest quality for the production of strong flour; but the present inspection laws for the Manitoba Inspection Division are so framed as to discourage the cultivation of White Fife in the prairie provinces.

Preston, Huron, Stanley and Percy are red wheats which ripen earlier than Red or White Fife but are not quite equal to those varieties for making strong flour. Laurel is a red wheat of rather soft character.

BARLEY *Six-rowed.*—Mensury, Odessa, Claude, Mansfield and Royal. *Two-rowed.*—Standwell, Canadian Thorpe, Invincible and Sidney.

INDIAN CORN—*Early maturing sorts.*—Angel of Midnight, Compton's Early and Longfellow. *Later sorts.*—Selected Leaming, Early Mastodon and White Cap Yellow Dent.

POTATOES—*Early varieties.*—Rochester Rose, Early White Prize, Bovee. *Medium to late sorts.*—Carman No. 1, Uncle Sam, Canadian Beauty, American Wonder and Late Puritan. These later varieties are as a rule more productive than the earlier kinds.

Applications should be addressed to the Director of Experimental Farms, Ottawa, and may be sent in any time before March 1, after which the lists will be closed, so that all the samples asked for may be sent out in good time for sowing. Parties writing should mention the sort or variety they would prefer, with a second sort as an alternative, and should the available stock of both these varieties be exhausted, some other good sort will be sent instead. Those applying for Indian corn or potatoes will please bear in mind that the corn is not available for distribution until March or April, and that potatoes cannot be mailed from here until danger from frost in transit is over. No postage is required on mail matter addressed to the Central Experimental Farm, Ottawa.

.E22
S
133
.E22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

ON THE

BREEDING, FEEDING AND GENERAL MANAGEMENT

OF

POULTRY

PART I

BY

A. G. GILBERT

Poultry Manager

PART II

BY

VICTOR FORTIER

Assistant Poultry Manager

BULLETIN No. 54

FEBRUARY, 1906

PUBLISHED BY INSTRUCTION OF THE HON. SYDNEY FISHER, MINISTER OF AGRICULTURE

OTTAWA, ONT

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

ON THE

BREEDING FEEDING AND GENERAL MANAGEMENT

OF

POULTRY

PART I

BY

A. G. GILBERT

Poultry Manager

PART II

BY

VICTOR FORTIER

Assistant Poultry Manager

BULLETIN No. 54

FEBRUARY, 1906

PUBLISHED BY INSTRUCTION OF THE HON. SYDNEY FISHER, MINISTER OF AGRICULTURE

OTTAWA, ONT.

To the Honourable
The Minister of Agriculture.

SIR,—I have the honour to submit for your approval Bulletin No. 54, of the Experimental Farm series, on 'The Breeding, Feeding and General Management of Poultry', prepared under my direction jointly by the Poultry Manager and the Assistant Poultry Manager of the Central Experimental Farm.

Part I has been written by Mr. A. G. Gilbert, Poultry Manager. In this is discussed the principles underlying profitable poultry raising; description of breeds; rations and manner of feeding them; the moulting of fowls with methods of shortening this period of non-production; and other topics. There are also short chapters on turkeys, ducks and geese.

Part II has been prepared by Mr. Victor Fortier, Assistant Poultry Manager. This treats of incubation, natural and artificial; poultry raising; the fleshing of chickens and the fattening of hens; poultry buildings and runs, and the general treatment of poultry including diseases, injuries, &c.

The subjects discussed are of wide and general interest. The poultry industry is developing rapidly in Canada, and there is an abundance of room and opportunity for a still further extension of this profitable branch of farm work.

It is hoped that the information contained in this bulletin, the result of the accumulated experience of many years, will prove helpful to farmers generally throughout the Dominion; to those who are engaged in poultry keeping in towns and cities, also to such as are making a specialty of the poultry business, and that thus a considerable impetus may be given to this most important industry.

I have the honour to be,

Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, February 1, 1906.

PART I

THE BREEDING, FEEDING AND GENERAL MANAGEMENT OF POULTRY.

(*By* A. G. GILBERT, *Poultry Manager, Central Experimental Farm.*)

The aim of this bulletin is to place in the hands of the farmers and others interested in successful poultry culture—throughout the Dominion—such information as long experience has shown to be best calculated, when put into practical operation, to bring the largest returns at the least cost.

That there is a paying margin of profit in properly managed poultry has been shown by experimental work as well as by results achieved by well known farmers and published by them, from time to time, in the Poultry and Agricultural press. That margin of profit has been found to vary in amount according to the favourable or unfavourable circumstances of the producers. Some are more favourably situated as regards location to a good market than others; some may have feed in greater quantity and at cheaper cost than others, climatic influences may be a factor in certain cases, but under all the conditions named satisfactory percentages of profit have been secured. Farmers in the neighbourhood of a city or town market where high prices are common, or, within easy reach by railroad of the same, have better opportunity to make a larger margin of profit than those in other parts of the country and who by force of circumstances have to sell to the collector of eggs and chickens, or, to country stores, transactions with the latter being often in the way of trade.

WHAT IS A FAIR MARGIN OF PROFIT?

Under favourable conditions farmers who have corresponded with our department or the press have stated their margin of profit to be highly satisfactory.

Mr. A. McPhadden, Dominionville, Ont., president of the local Farmers' Institute, has stated that by selling new laid eggs in winter at 40 cents per dozen and a superior quality of poultry in the early fall months at 10 cents a pound to Montreal dealers that he has found, after a careful account of cost, a profit of two hundred per cent.

Mr. Wm. Moe, of South Franklin, Que., claims by obtaining eggs in winter and sending them to a Montreal dealer as well as his poultry in summer to make one hundred and eighty per cent over cost.

J. R. H. of Wentworth Co., Ont., in *Farmers' Advocate* of March 9 last says after describing his methods of management:—'Have had eggs all fall and winter in good supply. Have kept account and have sold more than $2 worth of eggs for every $1 worth of feed consumed. And in growing early chickens for market have had $3 for $1 cost. I find I can raise chicks to eight weeks for $8 per hundred and make them ready for market. Yes, my hens pay and pay well.'

Our own experimental work has also shown satisfactory profit over cost of feed.

THOROUGH KNOWLEDGE OF MANAGEMENT ESSENTIAL TO SUCCESS.

But before margins of profit, such as shown, can be secured, it must be borne in mind that a thorough knowledge of how to manage is imperative. Successful poultry keeping is an exact and exacting science. Exact, because if not enough food is given there is little or no product, if too much, the fowls become too fat and the result is the

same. Exacting, because adaptability, keen observation, untiring perseverance, and a proper appreciation of the value of little essentials, coupled with a liking for the occupation are indispensable. The roadway to successful poultry keeping is strewn with the wrecks of individual, or combined effort, in attempts at attaining profitable results without the requisite knowledge of how to do so. It is well that this should be understood, at the outset, by the large number of correspondents from whom so many letters are received on the subject of poultry keeping. These correspondents may be classified as follows :—

1. The correspondent who has heard that there is a large margin of profit in the production of broilers, and would like a description of the necessary plant, method of management, estimate of outlay and all particulars in order to successfully prosecute the business. Would selling the eggs in winter at 40 cents per dozen pay better than by converting them into 'broilers'?

2. The correspondent who is confident that there is money in poultry. Having a limited sum of money, is willing to invest it in a small poultry plant. Has little or no knowledge of poultry, but would like all information as to quantity of land required, latest styles of poultry houses, number and kind of fowls, whether grain feed should be grown or purchased, most economical rations, and all such instruction as is calculated to lead to success.

3. The enquirer who has lost his health in business. He is convinced that poultry keeping may be made a means of livelihood as well as a restoration of health. Desires information as to the quickest way of acquiring knowledge of how to proceed.

4. The correspondent who has had experience in poultry raising in the mother country and intends to devote his time to its prosecution in this country in conjunction with market gardening, or small fruits, or both, would like all information as to most suitable breeds of fowls, accommodation, feed and management most suitable to this country.

5. The enquirer who is situated on the outskirts of the city and has time and room to permit of the pleasurable and profitable keeping of a number of fowls. How best can he carry out his intention?

6. From farmers enquiring as to what has been found the best variety of fowls for eggs and flesh. the best and cheapest style of poultry house, how many fowls can be profitably handled by one man, and where are the best paying markets for eggs in winter and chickens in summer?

ANSWERS TO THE ABOVE.

It is evident that the operations outlined by Nos. 1, 2 and 3 would be that of specialists requiring expert knowledge and special facilities. Such knowledge can best be acquired by an apprenticeship at a large poultry plant of which, at present, there are only two or three in Canada, but many in the eastern United States. Broiler raising is the most advanced phase of poultry keeping, requiring 'marked aptitude' in combination with expert knowledge and a special plant. Operations in large establishments commence in November or December and from that time forth chickens are artificially hatched and reared in great numbers until put on the market in spring and early summer, say from March to June, the period of highest prices. Broilers are usually sold at two or three months of age, averaging from one to one and half pounds each or two to three pounds per pair and are worth $1.25 to $1.50 per pair. The hatching and rearing of ducklings in the manner described is conducted on a very large scale by several large establishments. The young ducks are placed on the market at nine to ten weeks of age and usually weigh four to four and a half pounds each or eight to nine pounds per pair. Broiler raising is a branch of poultry culture not suitable to the ordinary farmer who, if he has eggs, will find far more profit in selling them at thirty, thirty-five or forty cents per dozen than by attempting to convert them into broilers.

Nos. 4 and 5 will find much useful information in the reports issued from our poultry department and from this bulletin. They may also learn by experience, which is inevitably slow but with them need neither be unpleasant nor unprofitable. Attend-

ance at a short course of poultry instruction at one of the agricultural colleges would doubtless be beneficial. Long experience has shown that unless practice is combined with theoretical instructions only partially satisfactory results are likely to be attained.

No. 6 is the case of the farmer which is entirely different from the others. Poultry keeping is essentially his business. Fowls are probably part of his live stock and of handling them he is likely to have already some knowledge. His poultry may not be of the most suitable variety, or his poultry house of the latest design. But these can be quickly remedied. He has the grain, the roots and other essentials in abundance, frequently in the shape of waste. To him the Experimental Farm reports and other publications are invaluable. He can, with the knowledge he is already possessed of, take the full benefit out of a short poultry course at an agricultural college. His position is generally such that by giving his poultry proper care and attention he can make them a profitable addition to his income.

DEALING WITH THE FARMER.

In dealing with poultry keeping and the farmer the exigencies of the latter, as to situation and circumstances, must be thoroughly understood. To the farmer his poultry is only one of many different branches of farm work. It would be simply misleading to induce him to keep more fowls, or, hatch out more chickens than he can successfully manage and rear. It is ever to be borne in mind that the great bulk of the egg and poultry supply must come from the farmers of the country, at all seasons of the year. It is also to be remembered that it is not from a few farmers with a great many hens each, that the largest proportion of this supply will come, but rather from the many farmers, with a few hens each, and who are, therefore, more likely to manage them successfully. There is no reason, however, why a farmer should not make a specialty of poultry raising, if inclination and circumstances lead him to do so. From 100 to 150 hens should not be too many for the ordinary farmer to profitably handle, and it should not be difficult for him to hatch out, and rear to marketable age 150 chickens. If he has help from wife or family, a larger number might be reared. How and at what season he can most conveniently and successfully do so is shown in the following pages.

THE MARKETS AND THEIR DEMANDS—THE FARMER'S OPPORTUNITIES.

There are two great markets open to producers, viz.:—The Home and British Markets. Both offer remunerative prices for the reliable product in the shape of eggs, and the superior quality of poultry at almost all seasons of the year.

The Home Market calls for fresh eggs and good poultry at all periods of the year. The better the quality of the poultry and the fresher the eggs the better are the prices obtained. The prices paid for new laid eggs in winter in the leading cities of the Dominion, range from 35 to 50 cents per dozen; for poultry, from 20 cents per lb. for early birds, to 15, 10 and 8 cents as the season advances. In London, Ont., the winter price of new laid eggs is 22 to 25 cents per dozen, but these are exceptionally low figures, general climatic conditions, doubtless, making the obtaining of eggs in winter comparatively easy. The aim of the producer, in this case, should be to reach the higher price markets of Toronto and Montreal. For both poultry and eggs, there is an increasing demand. The aim of the farmer should be to produce both at the seasons of the year when they are worth most money. A striking feature of the summer egg trade of the past two years has been the high price paid by leading purveyors, for the strictly new laid article. As high as 20, and in some cases 25 cents per dozen were paid last summer. The cause of these high prices is, perhaps, given in the words of a leading city grocer—with a choice trade—who remarked to the writer, 'Our customers will not have any other kind than the strictly new laid eggs with the flavour peculiar to them,' and we must try and meet this demand. Whether these unusual summer prices are only temporary, or, are likely to be permanent

remains to be seen, but the trend of the markets, in recent years, is to increase rather than decrease the value of the choice product.

The British Market and its requirements are :—Large eggs, 7 or 8 of which should weigh one pound, and preferably of brown shell. They should be of good flavour and as fresh as possible; clean and carefully packed, so as to present an inviting appearance on arrival.

Poultry only of the best market types and quality should be shipped, in order to secure the highest prices. As in the case of eggs, appearance and quality are great factors in determining values.

The careful packing of poultry and eggs may be attended to by the shippers, but it is only the farmers who can place the fresh eggs and poultry of the desired type and quality in the hands of middleman, storekeeper or shipper. Cold storage facilities are such that the products are kept in excellent condition *en route.*

HOW THE REQUIREMENTS OF THE MARKET MAY BE RESPONDED TO.

Farmers and other producers should at once realise that success in meeting the requirements of the markets enumerated can best be brought about by compliance with the following conditions, viz.:—

1. Their fowls should be of a variety that are as nearly all the year round money makers as it is possible to have them.
2. They should come from constitutionally strong and good egg-laying strains.
3. They should be good winter layers; moult in midsummer, and be of the best market types, so that their progeny will be the same.
4. To have the winter layer and flesh producer combined will necessitate a choice of one of the dual purpose or utility varieties, as described further on.
5. Should eggs only be required for selling at all seasons, except the moulting period, one of the non-sitting varieties will answer the purpose.
6. In procuring eggs or stock the purchaser should carefully ascertain that they come from the best egg-laying strains and market types.

THE DIFFERENT BREEDS AND THEIR CHARACTERISTICS.

Long experience has shown that no varieties of fowls are better suited to the requirements of farmers and others than barred and white Plymouth Rocks, white Wyandottes and buff Orpingtons. Both barred Plymouth Rocks and white Wyandottes are to be found in every locality, and eggs from them may be had at reasonable cost. No variety seems to have a greater hold on the farming community than the barred Plymouth Rock. The Orpingtons are comparatively new comers, but have rapidly made their way to a first place in the utility class. Particularly may this be said of the buff variety. The points of merit of the different varieties of the most serviceable breeds are as follows :—

PLYMOUTH ROCKS.

There are three varieties of this breed, viz.: barred, white and buff, all of which are good for eggs and flesh. The following descriptions refer to these different varieties :—

Barred Plymouth Rocks.—As shown in No. 1, plate 1. Natives of America, first making their appearance in the Eastern States. Pure bred birds should have yellow beaks, legs and toes. Faces, combs and wattles bright red. Eyes bright and rich bay. The plumage should be bluish gray and distinctly barred to the skin. Young females sometimes have a slightly dark stripe down the beak, but this is permissible in young birds. Well bred females make good winter layers up to two years of age; after this they are apt to put on fat and become unprofitable. The chickens are hardy, of good market type, and should make when properly fed and cared for, weight development of

one pound to one pound and a quarter per month especially after the first month. The standard weights of this variety are:—

	Lb.	Oz.
Cock	9	8
Cockerel	8	0
Hen	7	8
Pullet	6	8

Colour of eggs, dark or light brown, according to strain.

White Plymouth Rocks—(See No. 2, plate 1.)—A popular and well known variety and one which seems to be improving from year to year, doubtless the result of careful breeding. The points are the same as in the Barred Plymouth Rocks, with the exception of plumage, which should be pure white. Weights are the same as in the first-named variety. Colour of eggs brown, preferably dark brown.

Buff Plymouth Rocks.—A variety which is not so old as the two others named, but one which is gaining many friends on account of its merits as well as handsome appearance. The weights and points are the same as with the others with the exception of plumage, which should be golden buff of even shade.

Wyandottes.—The Wyandotte family, which is well known and popular, is composed of several varieties, viz.:—

Silver Laced Wyandottes—The first and oldest variety and one possessing much merit as a layer and market fowl, as well as beauty of plumage. The hens make good winter layers, good sitters and good mothers. The chickens are hardy and make quick growth. Of late *Silver Laced Wyandottes* have not been so numerous as in previous years, perhaps owing to the favour with which the newer and equally good varieties have been received, notably the White. For standard weights see White variety. Colour of egg, light brown.

White Wyandottes.—(See No. 3, plate 2.)—A typical fowl for the farmer, being blocky, broad in breast, with meaty body and having a low rose comb. Hens are excellent winter layers. Chickens are hardy and make flesh development equal to that of the *Barred Plymouth Rocks.* Great favourites with broiler raisers, particularly in the Eastern States.

Standard weights are:—

	Lb.
Cock	8½
Cockerel	7½
Hen	6½
Pullet	5½

Distinguishing points are:—Yellow beak, shanks and toes; bright red comb, face, wattles and earlobes; plumage and quills, pure white; colour of egg, light brown.

Golden Wyandottes.—A very handsome as well as useful variety, and one which has many friends and admirers. The plumage is beautifully marked and is described in the language of the Standard as, 'short, close, golden bay in colour with a black stripe on the feathers, wide at the base and extending to a fine point.' Weights, same as the white variety.

Buff and Black Wyandottes are to be found in many localities. The former are in greater number than the latter. They are useful as well as handsome, and are likely to occupy a front place among the utility breeds. Weights same as the white variety.

Other breeds of the American class are:—

Javas.—Black, mottled and white.

Dominique.—One variety called the American Dominique. It is noted as a progenitor of the Barred Plymouth Rock.

Jersey Blue.—A variety comparatively unknown outside of the Eastern States where it originated.

Rhode Island Reds.—A popular breed and one found in the hands of many farmers in the state in which it originated and the name of which it bears. They are becoming

more popular in other localities owing to their good reputation as layers and market types. The flesh has a slightly yellow tinge, which makes it rather acceptable to the prevailing taste in the United States.

Asiatic Group.

The Asiatic family is the oldest one known in poultry history, and from it may be traced many of the most popular English, French and American varieties of to-day This class is composed of eight varieties, as follows :—

Light Brahmas.—(See No. 4, plate 2.)—A large and handsome fowl, which for a long period has been a great favourite as layer and table fowl, and is yet so regarded by many breeders The advent of the more rapidly maturing and smaller boned Plymouth Rock and Wyandotte fowls has been the cause of the Brahmas taking second place as a leading general purpose variety. For many years they were the choice variety with Eastern States broiler raisers. Now the White Wyandottes or Barred Plymouth Rocks have largely taken their place. Some strains are excellent layers of dark brown eggs of large size. Chicks are hardy and make steady growth. Hens are rather heavy to put on early spring eggs when shells are apt to be thin, but they are quiet and careful mothers. Light Brahmas are the heaviest variety of the Asiatic breeds.

Standard weights are :—

	Lb.
Cock	12
Cockerel	10
Hen	9½
Pullet	8

In pure-bred Light Brahmas the points called for are: Bright red face, comb, wattles and ear-lobes; yellow shanks and toes; beak, yellow with dark stripe down the upper mandible.

Dark Brahmas.—Are not so numerous or well known among the farming community as the light variety. The females are beautifully marked. Characteristics much the same as the variety first named. The standard weights of this variety are slightly different from the whites, and are :—

	Lb.
Cock	11
Cockerel	9
Hens	8½
Pullets	7

Buff Cochins.—Are a well-known and favourite variety of the Cochin group. They have been extensively used for crossing purposes both in the older countries and on this continent. Crosses of Buff Cochin with Indian Game and Dorking have long been favourite broiler-making crosses. The hens of this variety lay a dark brown egg of large or small size according to age. They make faithful mothers and their chickens are hardy. The weights of this group are the same as Dark Brahmas.

White, Black and Partridge Cochins.—Are well known and liked. Hens are layers of dark brown eggs of rich colour and fairly large size. They make excellent mothers. Chickens hardy. The male of the black is half a pound lighter than those of the other varieties. Weights of all the others the same as in the case of Dark Brahmas.

Black and White Langshans.—Of these the former variety is much the best known, but both have good points as layers and table fowls. Their flesh is white, of fine grain and superior quality. The females lay eggs of medium size and of rich brown colour. Chicks are hardy and grow well. Hens make excellent mothers.

Standard weights are :—

	Lb.
Cock	10
Cockerel	8
Hens	7
Pullets	6

Mediterranean Group.

This family is composed of four breeds, viz.: Leghorn, Minorca, Andalusian and Spanish, all non-sitters. They again embrace several varieties which are described as follows :—

White Leghorns.—(See Plate 3, No. 5.)—One of the best known and popular varieties of the Leghorn family. They are prolific egg-layers, as indeed are all females of the Leghorn group. There are no standard weights for Leghorns, Andalusians or Spanish fowls. Eggs are white in colour and of medium size, some strains laying eggs of large size. Chickens are hardy and make rapid growth.

Brown Leghorns.—Another popular variety with many admirers. They possess all the merits of the white variety, but their eggs are slightly smaller. Colour of egg, white. Chickens hardy and rapid growers.

Buff Leghorns.—A comparatively new, but popular variety. Eggs large and white in colour. Chickens hardy and quick growers.

There are rose comb varieties of the white and brown.

Other varieties of the Leghorn family are *Black Dominique* and *Silver Duckwing.* Neither of these varieties are as well known as the three first mentioned. All varieties of the Leghorn breed are non-setters.

Black Minorcas—(See Plate 3, No. 6.)—A well known and much appreciated variety. They have to a great extent taken the place of the Black Spanish, because they are larger, heavier and hardier. The hens lay large eggs, many of them weighing 6 to one pound and most of them 7 to a pound. The chickens are hardy and make vigorous growth. Colour of eggs, white. Non-setters. The standard gives Minorcas the following weights :—

	Lb.
Cock	8
Cockerel	6½
Hen	6½
Pullet	5½

White Minorcas.—Are not to be found in such numbers as the black variety. Eggs large and white in colour. Excellent layers. Weights same as the black variety. Non-setters.

Andalusians.—At times called Blue Spanish. A well known and popular variety of the Spanish family. A good layer of large white eggs. Like Leghorns and Minorcas when properly fed, cared for and housed, they have proved themselves fairly good winter layers. Chickens are hardy and grow well. They do not always breed true to the light blue slaty colour called for, and for that reason a number of chicks may be necessary to make up a full pen of the colour required by the standard. They are non-setters. They are not given weights by the standard.

French Group.

The French group of fowls embrace several breeds the best known of which are as follows :—

Houdans.—Crested fowls of mottled colour. They are non-setters, are good layers and plump in body and white in colour of flesh. The two latter qualifications coupled with a small frame go to make them a capital table fowl. As capons they are very acceptable on the French markets. They are great foragers and do best when they have range. The crest on the heads of the chicks, it is said, causes them to fall an easy prey to hawks. In this respect, however, they are no worse than Polish fowls. Chickens are hardy and grow well and fast. The standard weights are :—

	Lb.
Cock	7
Cockerel	6
Hen	6
Pullet	5

La Fleche.—These fowls are not in great number throughout the country. They are to be seen at the larger shows. Their standard weights are :—

	Lb.
Cock	8½
Cockerel	7½
Hen	7½
Pullet	6½

Crevecœurs.—These are comparatively unknown throughout this country although having a place in the American Standard. Their weights are :—

	Lb.
Cock	8
Cockerel	7
Hen	7
Pullet	6

Faverolles.—(See plate, 4 No. 7.) The Salmon (*Saumon*) variety is best known in this country, but as yet they are held by comparatively few persons. They are, however, steadily gaining ground. The merit of the Faverolle is that of a table fowl of small bone and fine quality of flesh. They are also fairly good layers of eggs of medium size. Mr. T. H. Robinson, the English Faverolle breeder, says of them :—'that they will attain a size and weight with less trouble than some of our finer breeds, and a young fowl of this variety will leave nothing in the way of quality to be desired.' The chickens make quick growth and are hardy.

Hamburgh Group.

The Hamburgh group embraces three breeds, viz. :—Hamburghs, Redcaps and Campines. These are again subdivided into eight varieties, six belonging to the Hamburgs, two to the Campines, the Redcaps being without a variety. The different varieties are :—

Black Hamburgs.—(See plate 4, No. 8.) Compact, small, tightly feathered birds with lustrous black plumage. They are good layers of white eggs slightly over the medium size.

Other varieties are :—Golden Spangled, Silver Spangled, Golden Pencilled, Silver Pencilled and White. All are excellent layers, but their eggs are of small size.

Redcaps, Golden and Silver Campines.—Are held by comparatively few breeders and are really unknown among the farming community. The Redcaps seem to be losing rather than gaining ground. Campines are birds of handsome appearance, medium size and good layers.

English Group.

The English group of fowls may be said to embrace many different kinds, and for the most part they have been valued for their egg laying and table qualities. As with the American breeds, the aim seems to have been a combination of egg laying and market types with small frame and superior quality of flesh. In this respect the English and French breeds may be said to be unexcelled, Both nations are also skilled in crossing varieties, with the aim of producing flesh with small frames and a fine quality of meat of white colour.

Some American varieties, notably *Siluer Laced Wyandottes*, have been so skilfully handled by the English breeders as to much improve them in size and markings. Some of the best known English breeds and their varieties are noted as follows :—

Coloured Dorkings.—Are well known in this country and have many friends. They are famous—as all the Dorking varieties are—for their table qualities. For many years Dorkings or their crosses have held first place in England and France as market types. The coloured variety in Canada has been found—when acclimatised—a most useful one. Their bodies are long, broad and deep; legs short and of flesh colours They have five toes on each foot, and so have many of their crosses. The female.

are fairly good layers of eggs of medium size, As with other varieties of fowls, some strains are much better layers of large eggs than others. Their standard weights are :—

	Lb.
Cock	8
Cockerel	7
Hen	6½
Pullet	5½

Silver Grey Dorkings.—(See plate 5, No. 9.)—These are very much the same as the coloured variety, the difference being in plumage and not in utility points. They have proved unusually good winter layers and market fowls in the hands of certain breeders. Some strains have shown symptoms of tenderness, but the eradication of this weakness is only a matter of careful manipulation and time. Weights, the same as in the first-named variety.

White Dorkings.—This variety is not so well known as the two preceding ones, but it is not without merit as an egg layer and table fowl. The fowls differ from the others in having rose instead of singled combs. They also slightly differ in weights, which are :—

	Lb.
Cock	7½
Cockerel	6½
Hen	6
Pullet	5

Buff Orpingtons.—(See plate 5, No. 10.)—Buff Orpingtons are one of many varieties of the Orpington family. They are comparatively new comers, but have taken a front place in the utility poultry ranks as winter layers and market fowls. There is great demand for eggs and fowls of this breed. They have light coloured legs and white flesh. Chickens are hardy and grow rapidly. Eggs are of medium, or, larger size, according to strain. Canadian Buff Orpington Club accords them the following weights :—

	Lb.
Cock	9
Cockerel	7½
Hen	7.
Pullet	6

White Orpingtons.—Are a most promising variety, and are likely to become popular on account of their merits as layers and table fowls. They are not yet well known, but will soon make many friends. Their characteristics are about the same as those of the buff variety, with the exception of the colour of the plumage, which is pure white.

Jubilee, Spangled and Rose Comb Buff and White Orpingtons.—Are varieties of the same family, which are yet in few hands. All claim more or less merit. The buff and white varieties are likely to be first in favour of fanciers and breeders for some time to come, as they are best known and have certainly made a favourable impression.

Among the English breeds may be classed the numerous family of Games, which are to be found in all parts of the Dominion. They are principally held for show purposes, but occasionally are used for crossing with other varieties. As a commercial fowl they are not much known. Of the Game family, the Cornish Indian variety is the best liked for market and for crossing with.

RATIONS AND MANNER OF FEEDING THEM.

In the composition of rations suitable to the different seasons of the year, farmers should find ample opportunity to utilize much of the waste of their farms, As a means to this end the mash (composed principally of ground grains) affords opportunity to use the waste of table, kitchen and barn, as is hereafter shown. By some authorities the

use of the mash is condemned as likely to make the layers over-fat and their eggs in early spring time unfertile. Experience has shown that an over-fat condition is generally the result of over feeding of hard as well as ground grains. Over feeding of any description of food is undesirable. The aim of the poultry keeper should certainly be to have an effective as well as cheap ration, but experience has shown that the cheapest ration is not always the best winter egg producer. The cheapest ration has been found to be the one which will bring the greatest number of eggs when they are worth most. As to the quantity of food which should be given, that depends upon whether the fowls are kept in warmed or cold houses, the latter in recent years being more popular especially when associated with scratching shed attachment, plans of which are shown in Part II of this bulletin. Experience has unmistakably made plain that fowls in the cold houses require more food to incite egg production than those in the warmer premises. Attempts have been made to show that such is not the case, but long experience and close observation lead to the conclusion that the colder the temperature of the house a greater quantity of food is necessary to produce the egg. Observation has also shown, in the case of fowls kept in cold houses, that it was the surplus quantity of food over and above that required for the sustenance of animal heat that went into the product. There is reason to conclude that the mistake is not unfrequently made of giving fowls in cold winter quarters food sufficient to keep up the animal heat, but not enough in addition to promote egg-laying. Hence the enquiry occasionally made by correspondents, "what can be the matter with my hens. They look well, are apparently in good condition, and yet do not lay?" It was also made evident by the results of past years that rations of a varied nature, when fed in liberal rather than stinted quantities, not only resulted in a larger egg yield, but the germs of the early spring eggs were strong and produced strong chickens. Were results similar in the case of the fowls kept in artificially warmed premises? Certainly not to the same extent. The fowls in the partially warmed houses laid fairly well during the winter season, but the germs in the eggs laid by them in early spring were weak, did not hatch well, and the chickens which were hatched from them in too many instances were weaklings. As shown in reports of the past three years, the germs of these eggs remained weak until the fowls ran outside and recuperated from their long term of artificial life and treatment. This has usually been about the 12th of April.

In the case of the fowls kept in cold premises, it seemed as if the feeding of the varied rations in generous quantity—in combination with fresh air—not only proved incentives to egg production, but kept the vitality of the laying stock so unimpaired as to permit of both a satisfactory egg yield during the winter months and in early Spring strong germs which developed into robust chickens. As a means to this end Ration No. 1 is recommended. Other rations follow.

Ration No. 1.

The composition of this ration permits of the utilization of the waste of table and kitchen. The waste is distinguished as follows :—

Table Waste.—What is left of porridge, potatoes and other cooked vegetables, scraps of meat, bread, &c., but no salt or fat substances.

Kitchen Waste.—Potato, turnip and other vegetable peelings, &c., which should be cooked. In the pot in which these are boiled a surplus quantity of hot water should be left into which the table and kitchen waste and such ground grain, or, grains as are most convenient should be thrown.

The whole should then be thoroughly mixed in proportion of one half waste and one half ground grains, or, thereabout, into a crumbly condition. When cool it may be fed morning and afternoon in quantity of two pounds to 15 hens, the latter presumably being under two years of age, as this class of food has been found most suitable to fowls of that age.

Noon.—About 12 ounces of oats should be thrown into each pen of 15 fowls so that the latter may be kept in exercise searching for the grain in the litter on the floor. Cabbage, or roots, such as mangels, turnips, &c., should be regularly supplied.

AFTERNOON RATION.—Should the mash be fed in the morning, whole wheat about 1½ ozs. to each fowl should be given at this ration and thrown in the litter so as to cause the fowls to exercise in looking for it. Care should be taken that this ration is not fed too late, especially in the winter, and that the layers go to roost with their crops filled.

Grit, to assist in grinding up the hard grain, crushed oyster shells and pure drink water should always be in supply. Vary the rations but feed regularly. If properly made up and fed in quantities as suggested the foregoing ration should embrace variety so necessary and be followed by liberal egg production, good health and the prevention of egg eating and feather pulling. Many of the diseases affecting poultry and the vicious habits practised by them may be traced to want of variety in rations, lack of exercise and to overcrowding.

For several winters past the foregoing rations have been fed with most satisfactory results, but more particularly noticeable were these good results during the winter of 1905 which will doubtless be remembered for its steady and lengthy cold.

The rations were fed to the birds named below under the conditions given as follows:—thirty-five in all of Buff Orpington and B. P. Rock hens of two and three years of age were kept in a rough and cheaply constructed house, part of a shed. During the winter these fowls laid well. On the 3rd or 4th of last April, 14 of their eggs were put under a broody hen—12 of these were Buff Orpingtons and two Barred P. Rocks. The result was 12 Buff Orpington and 1 B. P. Rock chickens, 13 strong and lively chicks. Unfortunately three were crushed to death in the nest, but the remaining 10, after 36 hours, were with the mother hen placed in a coop on the growing grass outside. Despite unusually cold weather the chickens made famous growth not one showing the least sign of weakness.

RATION No. 2.

This ration has been found effective in the production of eggs in winter, for many seasons past, in our department:—

Mash composed of—

Shorts	2 parts.
Ground oats	1 "
Cornmeal	1 "
Meat meal	1 "

The whole mixed into a crumbly condition with boiling water. Occasionally ground barley took the place of the ground oats and gluten meal that of the cornmeal. This mash, the ingredients of which had been well mixed, was fed in the proportion of one quart, imperial measure, weighed dry to 15 hens 3 times per week at morning, noon, or afternoon on different periods.

11 A.M.—Steamed lawn clippings twice per week. If fed in too great quantity, too frequently or not cut short the lawn clippings were found to make the hens crop bound.

AT NOON.—Five pounds of oats to every 100 hens thrown into the litter on the floor will keep the birds in exercise.

Three times per week cut green bones were given, in lieu of the oats, in proportion of one pound to every 15 or 16 hens.

AFTERNOON RATION.—Ten to 12 lbs. of wheat to every 100 hens which was thrown into the straw, or, chaff on the floor. If the layers seemed to want more grain, it was given to them.

Mangels were the most convenient roots and were always in supply. So were grit, crushed oyster shells and pure drink water.

RATION No. 3.

MORNING.—A mash of ground grains such as the farmer has in the most abundance mixed with potatoes, turnips or carrots boiled, in proportion of three quarters

grain to one quarter vegetables. Occasionally, instead of the boiled roots or potatoes, variety may be had by mixing with the mash steamed clover hay, cut into short pieces. Feed three mornings or afternoons of the week in proportion as given in No. 2. When mash is not fed in the morning whole grain should be given.

NOON —A few handsfull of oats 4 or 5 lbs. to 100 fowls to keep them in exercise. Cut bone may be given at this time, 3 times per week in lieu of the grain and in proportion of one pound to 15 fowls.

AFTERNOON.—Wheat is the best grain to feed at this time, and should be given before it is too dark for the fowls to see to search for it in the litter. It should be given in quantity of about two pounds to 15 layers, so as to send them to roost with full crops. If mash is occasionally given at this time, a good plan, after feeding, is to throw a few handsfull of grain in the litter so that the fowls can have it by looking for it.

RATION No. 4.

The following ration has been attended with satisfactory results in egg production and health of stock. It is recommended for pullets :—

Ground oats	2 parts.
Shorts	1 "
Cornmeal	1 "
Meat meal	1 "

When cut bone is fed the animal meal should be omitted. The mash should be mixed with boiling water and fed every morning or afternoon in proportion of two ounces to each layer. Dust into the grains, before the hot water is poured on them, half a teaspoonful of black pepper and about the same quantity of salt. Vary by mixing in, occasionally, boiled turnips, carrots or cabbage.

NOON.—Oats, or equal parts of buckwheat and oats mixed, in proportion of 4 lbs. to 100 hens. Roots, in the shape of mangels, turnips, &c., with grit, crushed oyster shell and pure drink water are supposed to be regularly supplied.

AFTERNOON.—When mash is not fed give one pound and a-half of wheat to every 12 pullets or 15 older hens. Cut bone should take the place of the noon ration 3 times per week, in proportion of 1 pound to 15 or 16 birds.

RATION No. 5.

The following ration is recommended for winter egg production by a farmer in the Eastern Townships who has the scratching shed attachments to his poultry houses, containing 80 fowls :—

MORNING.—Mash composed of cut clover, potatoes or turnips all boiled together and rounded up firm with wheat or other ground grain. Fed warm during winter.

NOON.—Grain thrown in the litter on the floor of the scratching sheds. We do this to make the hens search for the grain and so obtain exercise.

AFTERNOON.—A good feed of grain so as to send the birds to roost with their crops full.

We supplied green food in the shape of small apples or turnips. Grit, lime and pure water were before the layers all the time. Strict accounts of receipts and expenses were kept. We sold eggs in Montreal during winter at 40 to 45 cents per dozen, and in summer at 15 cents. Chickens at 58 to 64 cents per pair. Our fowls are pure bred. I do not believe in mongrels. The eighty fowls made us last year $219 ; the cost of keep for that period was $69.35, leaving a balance of $149.65 to the good. A good deal of this success is due to the help I received from my wife. "

RATION No. 6.

The following ration for use in cold poultry houses with scratching shed attachment as recommended by Mr. James Shackleton in his work entitled, 'System in Poultry

PLATE I.

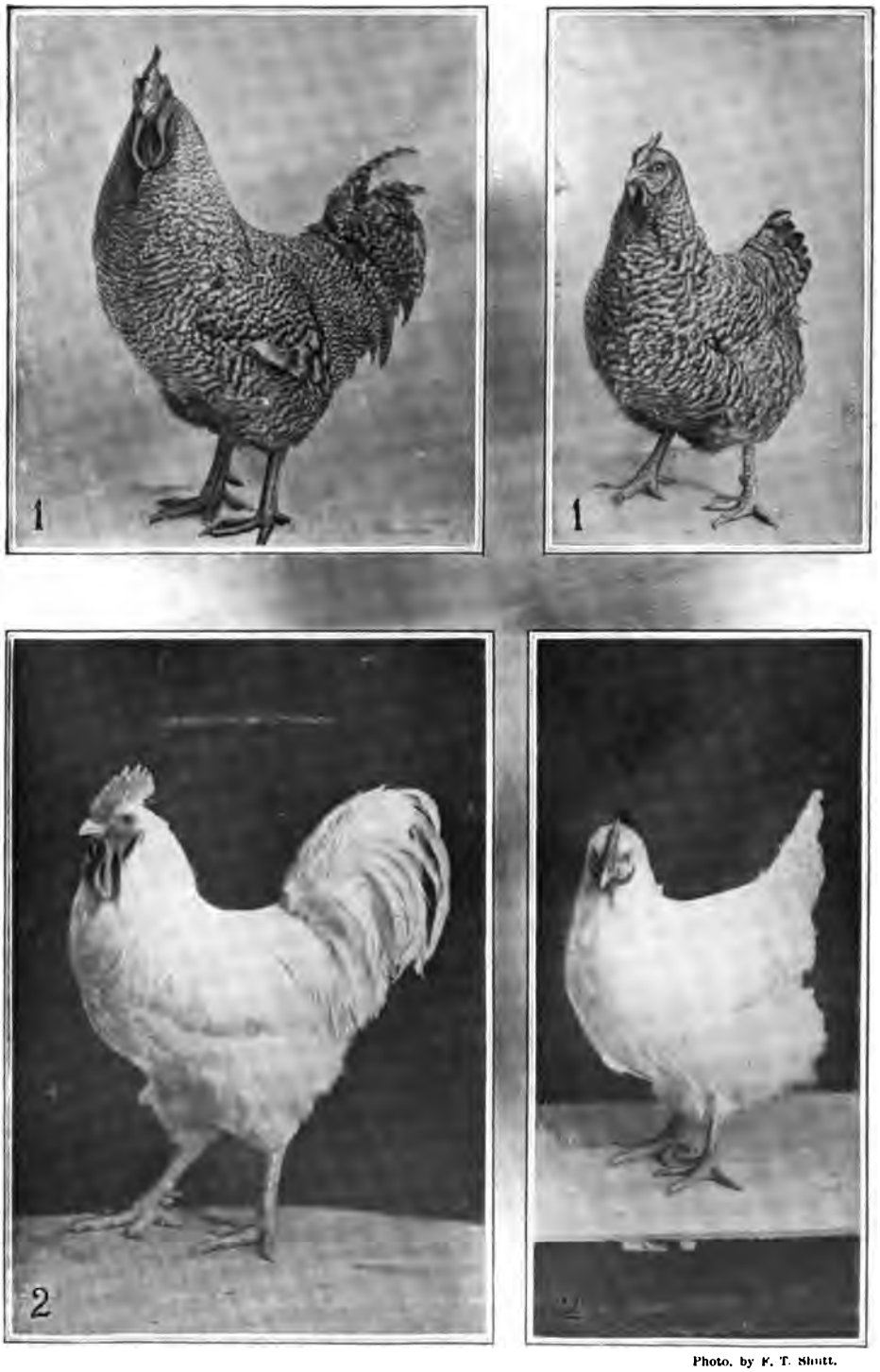


Photo. by F. T. Shutt.

No. 1.—Barred Plymouth Rocks. No. 2.—White Plymouth Rocks.

PLATE II.

Photo. by F. T. Shutt.

No. 3.—White Wyandottes. No. 4.—Light Brahmas.

Photo. by F. T. Shutt.

No. 5.—White Leghorns. No. 6.—Black Minorcas.

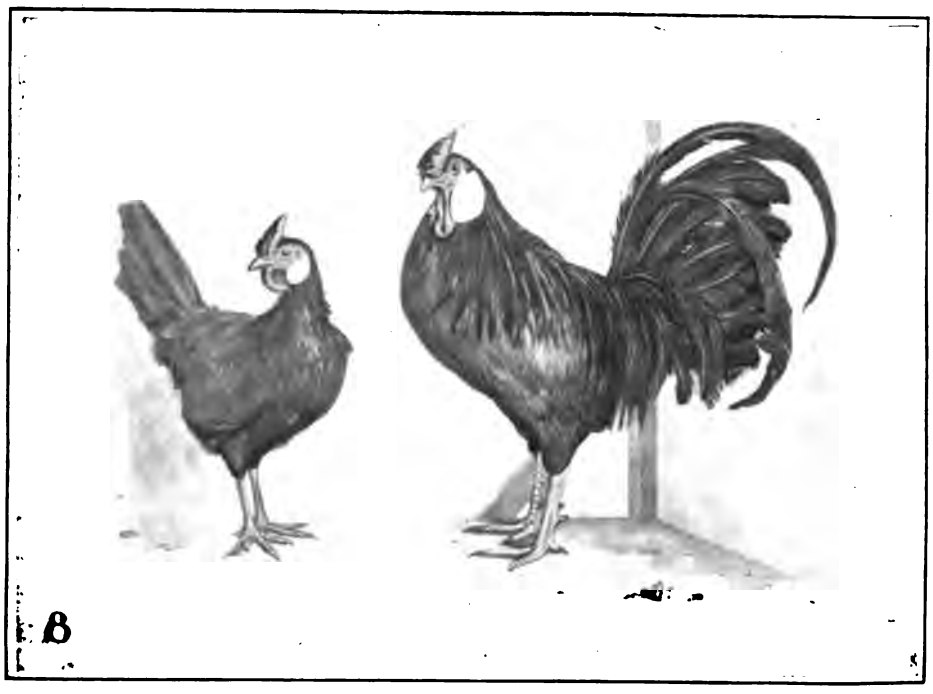


Photo. by F. T. Shutt.

No. 7.—Faverolles. No. 8.—Black Hamburghs.

Photo. by F. T. Shutt.

No. 9.—Silver Grey Dorkings. No. 10.—Buff Orpingtons.

Practice.' It is calculated for twenty-five birds of the Plymouth Rock or Wyandotte amily, twenty-two Brahmas or thirty-one Leghorns :—

Morning meal, 3 lbs. wheat (whole) ; noon meal, 1 lb. oats (whole) ; afternoon meal, mash, 5 lbs., composed of ground grain and mixed with boiling water and fed when cool.

Ration No. 7.

The following ration was fed during last winter to twelve hens and one cock which were located in pen No. 1 of No. 1 poultry house. The temperature of the building varied from below freezing at night to 35 and 40 degrees during the day.

Grain.—For 12 hens and one cock one and a half pounds per day, composed of half oats and half wheat. Of this three-quarters of a pound was fed in morning ration and three-quarters of a pound in the evening ration.

Mash.—Fed in quantity of three-quarters of a pound every three days at noon, composed of two parts shorts, one part ground oats, 1 part ground barley.

Cut bone, twelve ounces every three days ; beets, twelve ounces every three days ; grit, ground oyster shells, drink water regularly supplied.

Ration No. 8.

Used last winter in No. 3 poultry house the temperature of which was similar to that of No. 1.

Grain.—For 10 hens one and a quarter pounds per day composed of one-half oats and one-half buckwheat, fed in quantity of ten ounces in the morning and ten ounces in the evening.

Mash.—Of same composition as No. 1. Quantity fed—three-quarters of a pound in the morning and three-quarters of a pound in the evening.

Cut bone, ten ounces every three days ; beets, ten ounces every three days, grit, ground oyster shells, &c., in regular snpply.

Ration No. 9.

The following ration was given last winter to 24 hens which were kept in a newly-erected poultry house with scratching-shed attachment. There was no artificial heat.

From Nov. 1 to Dec. 15, 1904 :—

Grain.—$\frac{1}{3}$ wheat, $\frac{1}{3}$ buckwheat, $\frac{1}{3}$ oats. Three to 5 lbs. per day.
Mash.—Same as No. 7, $1\frac{1}{2}$ lbs every 3 days.
Cut-bone.—$1\frac{1}{2}$ lbs. every 3 days.
Beets.—$1\frac{1}{2}$ lbs. every three days.

From Dec. 16, 1904, to March 10, 1905 :—

Grain.—5 to 6 lbs. per day.
Mash.—2 lbs. every 3 days.
Cut-bone.—$1\frac{1}{2}$ lbs. every 3 days.
Beets.—1 lb. every 3 days. When beets were given another pound of cut-bone was also fed.

From March 11 to warm weather :—

Grain.—3 to 5 lbs. daily.
Mash.—$1\frac{1}{2}$ lbs. daily. (Hens running at large.)

In April the cut-bone was replaced by one-fifth of meat meal, which was added to the mash. In warm weather there was a difficulty in keeping the cut green bones.

Meat meal was found a convenient means of replacing it. It will be seen from the above that the quantity of rations fed were more or less according to the temperatures of the seasons.

Quantities of Rations Required.

Experience has shown that the exact quantity of ration needed depends partly upon the age of the fowls and partly upon the temperature of the house in which the fowls are kept. Pullets in moderately warmed houses, with a temperature of 40 to 45 degrees, have been found to lay well and keep in good health on a quantity of food which, if it had been given to hens of two years of age in the same temperature, would have made them overfat. Again, two and even three year old hens have been found to lay well in a cold house, and not only keep healthy but the germs of the eggs laid by them, in early spring, were strong and hatched strong chickens, on a quantity of food which, if it had been given to hens of similar age, in a warmed house, would have resulted in disaster. In his work entitled, 'Poultry for the People,' Mr. Alex. Comyns, the late editor of 'Feathered World,' of London, Eng., on the subject of feeding exact quantities to poultry says: 'Where the idea of feeding fowls by weight originated I hardly know. A hen requires different amounts of food according to her size, her circumstances as to locality, temperature, &c., her condition, as to whether she is laying or moulting; and yet poultry keepers are anxious to lay down a hard and fast line as to the amount of food to be given her. The only rule as to quantity which can be followed with advantage is to give as much of the proper kind of food as the birds will eat greedily without waste and without growing unduly fat.'

While there is doubtless difficulty in determining exact quantities to feed, yet close observation during many years on the part of the writer and many other poultry keepers, has led to conclusions as to weights and measures which when practiced have proved effective. Some of these are summarized as follows:—

Estimated Quantities.

Mash.—2 ozs. to each fowl per day.

Grain.—4 " " "

Cut bone, boiled beef heads or meat. One pound to 15 layers three times per week.

Meat-meal and beef scraps, at such times as cut bone is not fed, 2 ozs. per fowl. Meat-meal is generally mixed in the mash. Beef scraps are most frequently given alone and occasionally in the mash.

Green Stuff.—In shape of lawn clippings, clover hay, &c. The former should be cut short, steamed and given alone in moderate quantity twice or thrice per week. Clover hay also cut short and steamed is generally used in the mash in proportion of one-fourth of its weight. It may be given alone, steamed or dry, where vegetables or roots are scarce.

Roots or Vegetables.—The latter, if in the shape of cabbage, should be hung two feet from the floor of the pens, so as to incite the hens to exercise by jumping for it. Cabbage is also used in the mash when boiled. Roots, such as mangels, turnips. &c., should be in supply at all times.

Grit for grinding up hard food in the gizzard and ground oyster shells to make time for shell and pure water should constantly be furnished the layers. The attention to these details are all important.

There may be, and doubtless are, forms of waste not mentioned here, to be found on farms throughout the country and, which, if clean and wholesome, may be used to good purpose.

Certain Conclusions.

The feeding of rations in composition and manner as outlined has shown:—

1. That variety in composition of rations is necessary to complete success. Times of feeding should be regular.

2. That where there has been variety as outlined in rations there has been neither egg eating nor feather picking.

3. That where varied rations were fed during the winter season to fowls—even two and three years of age—and which were kept in cold houses, resulted in satisfactory egg laying, with strong germs and robust chickens in early spring.

4. That the long continued feeding of an unvaried ration is apt to lead to diseased conditions.

In connection with the feeding of rations it has been advised by some authorities to lessen the quantity of the winter rations as the spring season opened. Others contend that such can only be done at expense of vitality, fertility of eggs, strength of germ and size of egg. With the latter view, the experience of many years leads the writer to agree.

In spring time there is certainly an increased number of eggs laid, and most likely, in many cases, by hens which have laid previously but few eggs, or, it may be none at all, but notwithstanding it was not found desirable to lessen the quantity of food. When the breeding season is over and such hens as are not under experiment are allowed to run at large, rations have been reduced but with the object of bringing on the moult.

THE MOULTING PERIOD.

In order to have early and steady winter layers it is necessary that the fowls should moult during the late summer months. The moulting period has hitherto been regarded as a season of non-production. It occurs once every year and means the shedding of the old feathers and the growth of new ones. The time of moulting has usually been from 10 to 12 weeks, but by careful treatment and the feeding of suitable rations the period has been shortened. As much enquiry is made from time to time as to how to bring on an early moult, the following plan of management, which has been successfully practiced in our department for many years, is outlined :—

The sale of eggs for breeding purposes being over by the end of June, during the first week in July the male birds were removed from the breeding pens to another building containing small compartments with outside runs. The breeding stock as well as all other hens were then allowed to run promiscuously in the field in the rear of the poultry buildings, where there was grass, clover and shade, three important essentials. At this time the rations were reduced to half quantity. The effect of this was immediately to very much reduce and ultimately to almost entirely stop egg production, which was the desideratum. The half rations were continued for two weeks, when full quantity was resumed as follows :—

Mash composed of coarsely ground oats two parts ; shorts one part ; gluten meal one part with beef scraps in proportion of one pound to 15 fowls. The mash, which in summer was mixed with cold water, was fed three times per week. At times a small quantity of linseed meal was added. The beef scraps were used in lieu of cut green bones, because it was not convenient to procure the latter. If mash was fed in the morning, wheat or oats, or both mixed, were given in the afternoon, or *vice versa*. On such days as mash was not given grain took its place.

Dr. Sanborn, a well known authority on poultry management, says in regard to the moulting period : " A moulting hen is easily fattened. Hence at this period feed lightly of those foods which produce fat. Corn, corn meal, middlings, potatoes, must be used sparingly. Increase the amount of green bone, bran and skim milk, a run in a field of clover will be a help. Keep all males by themselves during the moulting period. Shelter the hens from storms or cold rains. The ideal place for a run is an apple orchard where in addition to the grass may be found insects in the fallen fruits, &c. Birds should go into the moult not fat, free from lice and with no mites in the house. "

A correspondent in Nova Scotia writes that he has reduced the moulting period by feeding, in generous quantity, beef heads boiled, broken into small pieces and put

through his bone cutter. As a result of this treatment there was hardly any cessation of laying. The experience of many years has shown :—

1. That yearling hens usually moult earlier and easier than older ones.
2. That moulting is more gradual in some cases than others.
3. That the progeny from parent stock which have moulted during summer, in the majority of cases, have usually moulted at the same period.
4. That moulting hens are much benefited by a run in a field where clover, grass and insect life may be found.
5. That where moulting fowls are confined to limited runs, that meat in some form and green food should be regarly supplied.

HOW MANY CHICKENS SHOULD A FARMER BE ABLE TO CONVENIENTLY HATCH AND REAR?

In a previous page the farmer is advised to handle no more than 150 chickens, as an attempt to hatch and rear a greater number might overtax his time and energy. It is obviously waste of chicken life for a farmer to hatch out more chickens than he can successfully rear to marketable, or, laying age. In report of 1900 it is pointed out that the most suitable time for the great majority of farmers to hatch out their chickens is in late April or the first week in May, for the reason that unless provided with incubator room and brooding house—so as to be independent of outside temperatures—it would be inconvenient if not impossible for him to raise chickens, in paying numbers, at an earlier season. Experience and expressions of opinions from farmers strengthen that statement. Experience has also shown that the May hatched pullet will likely begin to lay in November and continue to do so all winter, while, pullets, hatched in earlier months are liable to moult and remain non-productive when eggs are at their highest value. The early May pullet is obviously the most suitable bird for the farmer. His chickens whether hen, or, brooder reared are likely to make more rapid progress at this time than any other for they literally seem to grow with the grass. As to the best means of hatching and rearing chickens farmers are rapidly finding out that if they desire to have early May chickens of uniform age and number that artificial means are necessary. There is no intention to belittle the hen as a hatching medium. She will doubtless be the favorite means of incubation with many persons, but where 150 chickens are wanted at one time and in the first week in May, a larger number of hens, than are usually obtainable in the second week in April, would be required to bring about such results. Mrs. Joseph Yuill, of the township of Ramsay, near Carleton Place, an experienced and successful poultry raiser, stated in an address given before the members of the Ottawa Poultry Association in October of last year 'that during the previous spring she had hatched by means of her incubator 101 chicks from 105 tested eggs.' Experience of many years has shown that chickens hatched in the last week of April, or, the first one in May, are the easiest to rear and consequently the most suitable for the farmer.

LICE AND DISEASE GERM EXTERMINATOR.

A remedy for lice infested premises and disease germs is frequently asked for. The following will be found effective :

Corrosive sublimate.....	4 ounces.
Common salt.....	4 "

Dissolve in two to four quarts of water. When completely dissolved, dilute to 25 gallons.

With this carefully spray every crevice, nook and corner of the house.

As the solution is highly poisonous, care should be observed in handling it.

Follow by whitewashing the premises. Before returning the fowls to the poultry house, see that they are entirely free from vermin.

A SERVICEABLE WHITEWASH.

A durable and lasting whitewash may be made as follows :—Put into a water-tight clean barrel half a bushel of unslaked lime. Slake the lime by pouring sufficient hot water in the barrel to cover the lime to a depth of five inches. Stir briskly until slaked. Add two pounds of sulphate of zinc and two pounds of salt dissolved in hot water. These ingredients will prevent the wash from cracking or peeling off. It is better to apply the whitewash while hot. If to be used for inside of poultry house, colony houses or coops add half an ounce of carbolic acid.

To colour the whitewash add yellow ochre, venetian red, or any other desired color.

THE PRESERVATION OF EGGS.

LIME-WATER—WATER-GLASS—THE GLYCERINE PROCESS.

By Frank T. Shutt, M.A., *Chemist, Dominion Experimental Farms.*

Experiments in egg preservation were begun at the Experimental Farm, Ottawa, in 1898, and have been continued every season since that date. In the course of these experiments, trials have been made with more than twenty-five different fluids and preparations that have been proposed or sold as egg preservatives. The work of these seven years has shown conclusively the superiority of lime-water over all the preservatives which we have tested.

THE PREPARATION OF LIME-WATER.

The solubility of lime at ordinary temperatures is 1 part in 700 parts of water. Such a solution would be termed saturated lime-water. Translated into pounds and gallons, this means 1 lb. of lime is sufficient to saturate 70 gallons of water. However, owing to impurities in commercial lime, it is well to use more than is called for in this statement. It may not, however, be necessary, if good, freshly burnt quicklime can be obtained, to employ as much as was at first recommended, namely, 2 to 3 lbs. to 5 gallons of water. With such lime as is here referred to one could rest assured that 1 lb. to 5 gallons (50 lbs.) would be ample, and that the resulting lime-water would be thoroughly saturated. The method of preparation is simply to slake the lime with a small quantity of water and then stir the milk of lime so formed into 5 gallons of water. After the mixture has been kept well stirred for a few hours it is allowed to settle. The supernatant liquid, which is now 'saturated' lime-water, is drawn off and poured over the eggs, previously placed in a crock or water-tight barrel.

As exposure to the air tends to precipitate the lime (as carbonate), and thus to weaken the solution, the vessel containing the eggs should be kept covered. The air may be excluded by a covering of sweet oil, or by sacking upon which a paste of lime is spread. If after a time there is any noticeable precipitation of the lime, the lime-water should be drawn or siphoned off and replaced with a further quantity newly prepared.

GENERAL PRECAUTIONS NECESSARY TO TAKE.

It is essential that attention be paid to the following points :—

1. That perfectly fresh eggs only be used.
2. That the eggs should throughout the whole period of preservation be completely immersed.

Although not necessary to the preservation of the eggs in a sound condition, a temperature of 40° F. to 45° F. will no doubt materially assist towards retaining good flavour, or rather in arresting that 'stale' flavour so often characteristic of packed eggs.

Respecting the addition of salt, it must be stated that our experiments—conducted now throughout five seasons—do not show any benefit to be derived therefrom; indeed, salt frequently imparts a limey flavour to the egg, probably by inducing an interchange of the fluids within and without the egg. Our advice is, do not add any salt to the lime-water.

WATER-GLASS AS A PRESERVATIVE.

Water-glass (sodium silicate) has been extensively experimented with, using solutions varying from two to ten per cent. On the whole, solutions two to 5 per cent. (two pounds to five pounds sodium silicate in ten gallons of water) have given better results than stronger solutions. Although in the main the results have been very fairly satisfactory, we are of the opinion that lime-water is superior as a preservative. Further, lime-water is cheaper and pleasanter to use than water-glass solution.

THE GLYCERINE PROCESS FOR THE TREATMENT OF EGGS.

This is apparently a misnomer, as glycerine, so far as the writer can learn, is not used in the process, which consists of momentarily (say about five seconds) dipping the eggs (which have been "pickled" in lime-water) in dilute muriatic acid, between one and two per cent. This acid dissolves any incrustation on the shell and gives the eggs a fresh appearance, *i.e.*, as if they had been treated with glycerine. Immediately on withdrawing the eggs from the acid they are well washed with water, as by a hose, to prevent further action of the acid and dried. This immersion in acid lessens the tendency of shell cracking when the pickled egg is boiled. Eggs should not be subjected to this treatment till about to be used, since the keeping quality of the egg is materially affected by the process.

The addition of glycerine to various egg preservative fluids has been tried at the Experimental Farm, but in no case did it prove satisfactory. The general effect was to induce the growth of mould.

TURKEYS.

THE DIFFERENT VARIETIES—THE BEST VARIETY FOR THE FARMERS.

How to Rear, Kill, Pluck, Dress and Pack.

There is doubtless money in turkeys to the farmers of the country. Climatic conditions in the greater part of Canada are favourable to turkey breeding. The Rev. John L. Simpson writing from the neighbourhood of Calgarry says, 'This is an ideal district for the raising ef turkeys, indeed for all kinds of poultry.' The writer when in the southern part of Alberta some years ago, came to the same conclusion. Other parts of the Dominion, are equally favourable. There are six varieties of turkeys. viz.: Bronze, Narragansett, White, Black, Buff and Slate. Of these the Bronze are the largest, heaviest and most popular. The standard weights of this variety are:

Cock	36 lbs.
Hen	20 "
Cockerel	25 "
Pullet	16 "

It is of first importance that the young birds should be kept in dry quarters. Too early setting is not advisable in this latitude. It is different where the temperature is milder in winter and spring earlier.

Great care is necessary in rearing the young birds until they 'shoot the red,' (get wattles, &c.) Young turkeys before 'shooting the red' are very tender, afterwards very hardy.

After Hatching.

After hatching the youngsters and their mother should be put in dry, comfortable quarters. The coop should be roomy, and so situated that mother and brood can easily be driven into it in case of rain. If possible let the young birds have a grass run. Care should be taken that mother and brood are not allowed on the grass while wet with dew. It will be found beneficial to remember this. Experienced breeders have traced the cause of death of many young birds, in their neighbourhood, to damp quarters, lice and indigestion, the latter doubtless caused by eating uncooked food. Unclean, carelessly mixed and uncooked rations have been the cause of death of many young birds. The mortality among young turkeys, every season, throughout the country is much greater than it should be, and in many cases may be traced to neglect of the points outlined.

Rations for Young Birds.

For the first few days feed the newly hatched birds on stale bread soaked in milk and squeezed dry. Mix with hard-boiled eggs and onions, both finely chopped. Curd or cheese made from sour milk may also be given.

Later on feed on granulated oatmeal, rolled oats, or a mash made of stale bread, onion tops, oatmeal, cornmeal or middlings, the whole mixed with skim-milk. The milk should be boiled and a little black pepper dusted into it, before putting it into the mash.

For the first five or six weeks feed four times daily. Afterwards three times.

At the time of 'putting on the red,' uncooked food should not be fed. At this period the young birds are likely to eat ravenously, but they should not be allowed to gorge themselves. After becoming fully feathered they require nothing but hard grain.

Turkeys are fond of roaming, and often wander away from headquarters. In this way many are killed by weasels, skunks and other enemies.

A good plan is to feed the hens and their broods grain every evening, and so accustom them to coming home. This, of course, when the young birds have reached the proper age and have range.

To Fatten.

Some breeders fatten their birds, intended for home market or shipment, by confining them in an enclosure or house and feeding heavily twice per day, morning and evening. Others allow the birds limited range during the day, feeding them in the morning previous to allowing them out and again in the evening on their return home. An excellent fattening ration has been found to be as follows:—A mash of finely ground oats and milk in the morning and whole grain at night. To the mash may be added boiled vegetables, table scraps, &c., and it is better if mixed with milk. With the proper variety, to commence with, there should be no difficulty in obtaining the desired flesh development.

Killing.

Birds intended for the British market should be of first quality, and carefully killed either by dislocation of the neck or bleeding at the mouth. But whether for home market or shipment none but birds in good condition should be sold. Previous to

killing the birds should be fasted for 24 hours so as to have the crop and intestines completely empty. If killing by bleeding at the mouth is adopted, it should be done as advised in the case of chickens killed in that way, viz., by the cutting of the roof of the mouth, at base of the brain, with a narrow, sharp knife, lengthways and across, If the roof of the mouth is pierced at the base of the brain, death is said to be instantaneous and painless. Dislocation of the neck is done by many persons in preference to the manner just described. When the neck of the bird has been dislocated the end of the neck should be two inches away from the head. After killing and during plucking the bird should be so held that its head will hang downwards, thus allowing the blood to drain towards and coagulate in the two-inch space between head and neck. The following note from a London, Eng., poultry-buying firm to one of their agents in Australia shows that the killing must be carefully done.

'Having purchased the several consignments of frozen poultry which you have had on show in the exhibition, I have written you our opinion of same. A, the quality very good; B, trussing very good; C, packing well done; D, killing may be capable of being very much improved on, as the necks of the birds are invariably very much discoloured, and appear almost unsaleable through this. I would suggest bleeding at the mouth, and not so much force used in dislocating the neck. I consider there is a good market here for your poultry, if you can send it, say, to arrive in England continuously from January to June.'

Plucking and Dressing.

This should be done as described in the treatment of chickens.

Packing.

The Dominion Department of Agriculture gives the following directions for the proper packing of turkeys intended for shipment:—

Every bird should be wrapped neatly in paper, the head with a quantity of thick paper to absorb any blood. The birds should be packed with their backs down and heads to one side.

Twelve to twenty-four birds should be packed in a case. The case should be packed quite full, so as to prevent birds knocking about inside, during transit or in cold storage.

The case recommended is 6 feet long by 20 inches wide, and from 7 to 11 inches deep. Top, bottom and sides are made of half-inch lumber, with a strengthening piece in centre, one-half inch thick.

The cocks and hens should be packed in separate cases.

The weights of the birds and their sex should be marked on the left-hand corner of both ends of the case.

A quantity of clean straw or wood pulp should be put on the bottom of the case and on top of contents, with wrapping paper between the birds and packing material, to prevent any possibility of injury.

Shipping Birds in Feather.

In shipping birds in feather the following directions should be followed:—

Kill birds by cutting in roof of mouth as described in previous page.

Before being packed the birds should be thoroughly cooled. Pack in air-tight barrels.

In packing the heads of the birds should be on the middle of their backs. The barrels should be marked so as to describe contents.

DUCKS.

There are several breeds of ducks, the best known of which are Pekin, Aylesbury and Rouen. The weights of the males and females of these breeds are as follows :—

	Lbs.
Pekin Drake	8
Young Drake	7
Aylesbury Drake	9
Young Drake	9
Rouen Drake	9
Young Drake	8
Pekin Duck	7
Young Duck	6
Aylesbury Duck	8
Young Duck	7
Rouen Duck	8
Young Duck	7

Mating.

From three to five ducks are allowed to a drake early in the season. Later in the season, when running outside, ten to twelve. The ducks should not be over two years of age.

Ducks lay from 100 to 140 eggs in a season. The eggs take twenty-eight days to hatch. Duck eggs are hatched by hens or ducks. They hatch well by incubator.

Rations and Treatment.

Ducks should be a source of profit to farmers who have opportunity to raise them as they grow rapidly and when properly housed are free from disease. The ducklings, when carefully looked after, should be ready for market in ten weeks, or just before their pin feathers begin to grow.

The following rations have been found successful in rearing ducklings :—

For the first three or four days, mash of cornmeal, a little hard boiled egg chopped fine, ground wheat or oats, or granulated oatmeal, the whole being mixed with boiling milk. The young birds are very fond of cabbage, lettuce or clover, which should be chopped fine and may be mixed in mash. Make mash crumbly. Give skim-milk for drink.

Later on a mash may be made of cornmeal, bran and oatmeal, with chopped green stuff, and mixed with skim-milk boiled.

Feed the young ducks five times per day. Keep them in dry quarters, out of the hot sun, and supply water in limited quantity in shallow dishes, so as to prevent them ducking into it.

After three or four weeks reduce the rations to four per diem. As the ducklings grow the rations may be added to by house-waste, ground bone, beef scraps or cooked meat, Small pieces of charcoal are aids to digestion. A small quantity of sand, say 5 per cent, added to the rations is beneficial.

Fig. 12. Pekin Duck.

Fattening.

To fatten, feed on ground grain, meal, beef scraps, &c., made into a mash. Barley meal is excellent in the soft food. Nothing should be fed that will give the flesh a bad flavour.

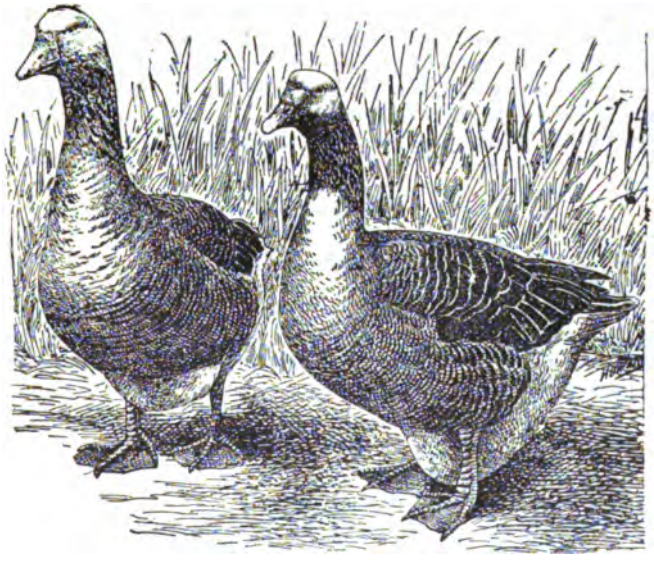
Killing and Picking.

Ducks are best killed by cutting into the base of the brain at roof of the mouth. Before killing, the feet of the bird should be caught in a loop and the latter fastened to a nail with head hanging downwards. The picking, which should commence immediately after killing, requires to be carefully done, so as to prevent injury to the carcass. Duck raising is carried on extensively by many breeders, principally in the United States.

GEESE.

The best known of several breeds of geese are the Toulouse and Embden. The other breeds, five in number, are Gray African, Brown and White Chinese, Gray Wild and Egyptian. The weights of the two first named are :—

	Lb.
Toulouse Gander	25
Toulouse Goose	23
Embden Gander	25
Embden Goose	25
Young Gander	20
Young Goose	18
Young Gander	20
Young Goose	18



No. 13—Toulouse Geese.

Geese are bred in considerable numbers by farmers throughout the country, but not to the extent that they should be taking into consideration their hardy nature and the little care required to bring them on to marketable age, once beyond the gosling stage.

Mating

In mating one gander to two females are used. In some cases three geese are allowed. On the other hand a pair is considered the better mating, as better fertility is secured.

Management.

In spring make large comfortable nests. As a rule two clutches of eggs are laid, sometimes three. The eggs should be collected immediately after they are laid as they are easily chilled. The breeding season generally begins at the commencement of February, sometimes earlier. Geese lay from 12 to 20 eggs before desiring to set. U. S. Farmers' Bulletin 64 says—'As soon as the goose shows an inclination to set, remove her and place her in a dark box or small coop and keep her there for two or three days with water for drink and no food. Then she may be placed back in the yards and she will begin another laying of eggs.'

"The first and second laying of eggs should be placed under hens. After the goose lays the second laying she should be confined again when she will lay a third laying. When she has laid the third laying she should be permitted to set on them. A goose will lay from 10 to 15 eggs in each of the second and third layings. It is recommended that after the eggs have been sat upon for 25 days that they be taken from the nest and be placed for one minute in water heated to a temperature of 104°."

After hatching leave hen and goslings in the nest for 24 hours. After the goslings have become thoroughly dry they should be removed with the mother hen to a coop for 4 or 5 days. At this age the hen may be taken away and the goslings allowed to roam, but they should be cooped up at night.

Rations

For first three days.—Similar food as that recommended for ducklings, or the following, by Mr. C. L. Darlington, Lloyd, N.Y.: cornmeal mixed with hard-boiled eggs, chopped fine, a pinch of black pepper and a handful of sand. After three days discontinue the eggs, and give bread soaked in skim or sweet milk, oatmeal, or broken rice boiled until soft, outer leaves of cabbage, onion tops, and all the grass they can eat. Keep the young birds from water, but give it to them in liberal quantities to drink. The same authority recomends as a fattening ration a liberal supply of barley meal and cornmeal, soaked in buttermilk. A grass run is indispensible.

Killing, Plucking and Dressing.

For local market, the goslings should be ready in twelve or fourteen weeks, and should be of large size at end of 16 weeks.

They should be killed by bleeding in the roof of the mouth, and all feathers taken off except on wing tips. For shipment and local market the geese are not drawn.

No bird less than nine pounds each should be shipped to the English market. They should be packed ten in a case.

Notes.

Goose eggs hatch in thirty to thirty-four days.

Some breeders assert that the worth of the feathers from a bird should nearly pay half the cost of its feed for one year.

PART II.

ON INCUBATION, THE REARING AND FATTENING OF CHICKENS AND FOWLS

POULTRY BUILDINGS, &c.

(By VICTOR FORTIER, *Assistant Poultry Manager, Central Experimental Farm.)*

INCUBATION.

Any practical poultry keeper will find it always to his interest to have the hatching of his chickens take place during March and April, so as to place his produce on the market as true broilers: chickens three months old on the 15th of June. These are a luxury, and they always command a good price.

Pullets for winter laying must be hatched as early as possible, at least never later than the 20th of May.

If it is wished to raise only from fifty to a hundred chickens, an incubator and brooder can be dispensed with and the hatching may be done by hens. But in poultry raising on a large scale, it is quite different. In such a business it will be necessary to place on the market at different seasons of the year many chickens of the same size and same age; and this can be accomplished only by artificial incubation.

With natural incubation, besides the drawback in having a number of hens to watch and attend to, these would stop laying for a whole month; the rearing of their chicks would also involve the sacrifice of about two more months. Altogether nearly three months would be lost for egg laying. This long period will be considerably reduced if the eggs are entrusted to an incubator.

SELECTION OF EGGS FOR HATCHING.—This selection is an essential question; the merit of the hen which has laid the eggs is therefore to be well ascertained. It is as important to know the source of the eggs that are going to be set in the nest or in the incubator, as to know the extent of the milking capacity of the cow whose heifer is in her turn to be kept as a profitable milker. The commercial and practical breeder must give careful attention to the selection of his stock if he is to have eggs suitable for incubation, and in order to succeed in the poultry industry the individual qualities of each hen have to be studied, just as is the case with other farm stock.

When a flock is composed of fifty to a hundred hens or more, each bird cannot be a first-class specimen; if eggs for hatching are taken just as they come, the average of the flock will probably be inferior, for the finest males will have mated with the poorest as well as the best hens.

By practising selection with a small number of good layers, it is easy to keep a flock possessing the best qualities of the particular breed.

Selection may be practised by careful examination of the birds, aided subsequently by trap nests. (See nests, page 30.)

SELECTION OF BREEDING STOCKS BY TRAP NESTS.

In order that the fowls in a poultry plant should make the highest margin of profit, it is necessary that every one of them should be prolific layers. Such layers can only be obtained by careful selection of and breeding from the fowls which show the best egg records in the course of the year. There are two methods of selecting the desirable fowls, viz:—by observation and by means of trap nests. The latter method is preferable, because it is more likely to be accurate. In selection by observation there is always an element of uncertainty. In the case of trap nests results are correct.

How the Trap Nests Are Operated.

The fowls to be tested as to their egg-laying qualities having been selected, a leg band bearing a distinguishing number is put on one of the legs of each fowl. One trap nest is usually allowed for every three or four hens. Thus in a pen of fifteen fowls there should be four or five trap nests. After the fowl has laid she is released by an attendant who at once records her egg-laying on a card conveniently placed in the pen. The following shows the form of card used at the Central Experimental Farm :—

Central Experimental Farm.

POULTRY DIVISION.

Daily Egg Record.

Breed.....

Month.... .... 190....

Hen No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total.

In this manner the history of each hen, good, bad or indifferent, is secured and recorded. The indifferent and bad layers are discarded, and the best layers are used to breed from, and so prolific egg laying strains of fowls are made.

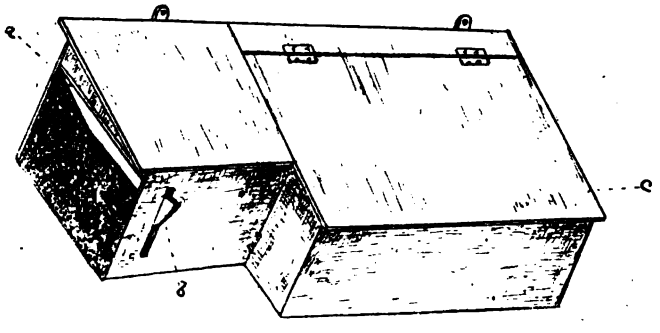


Fig. 14.—The 'Fortier' Trap Nest, in use at Central Experimental Farm, Ottawa.

The door (fig. 16) and the catch (fig. 18) are cut out in ½ in. board of the dimen sion given. It is important that the axle running through the catch be in the position as shown in fig. 17.

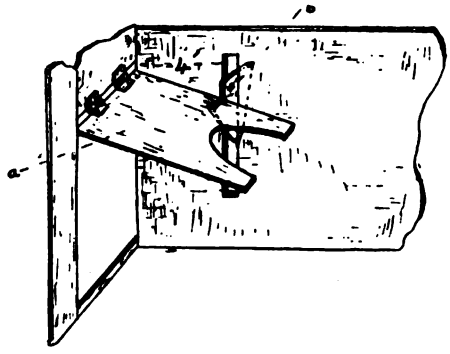


Fig. 15.—The Trap Nest set.

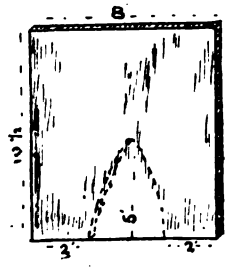


Fig. 16.—The door.

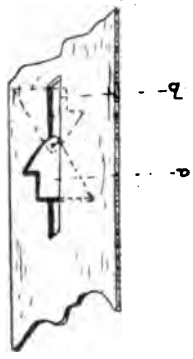


Fig. 17.—The catch in position.

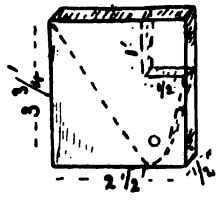


Fig. 18.—The catch.

On entering the nest, the hen raises the door (*a* fig. 15), which is resting on the catch (*b* fig. 15), when the catch immediately drop to the position shown at (*b* fig. 17), and thus prevents the door from being opened from the outside.

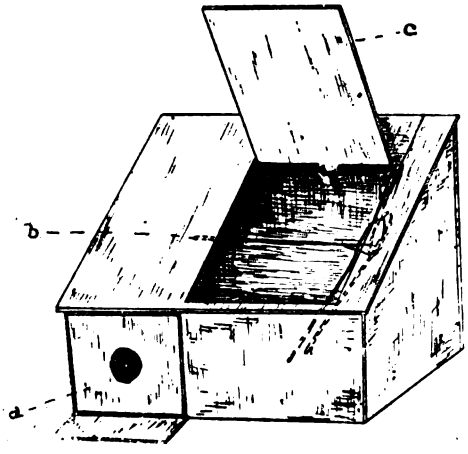


Fig. 19.

Fig. 19 *a*. The door. Fig. 19 *b*. The lever made of stout wire and suspended by staples as shown in fig. 20.

To set the nest, the door is opened and held in position by the wire (fig. 19 *b*).

On entering the nest, the hen comes in contact with the fork (*a* fig. 20) and forces it to the position (*b* fig. 20) which draws the wire from under the door when the latter falls and closes the entrance to the nest.

The hen is removed by raising the lid (*c* fig. 19).

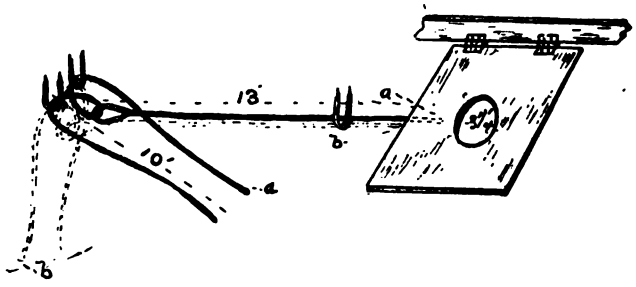


Fig. 20.

Where to Keep Eggs Suitable for Hatching.

Eggs for hatching must be kept in a place which is neither too warm nor too cold; a good temperature is from forty to sixty degrees F., in which the air is neither disturbed nor vitiated; and to avoid any vibration, they should be placed the small end downwards on a layer of grain. Thus stored, the eggs can remain for a fortnight to twenty days before being set for hatching. They must not be put either in bran, sawdust, ashes, very dry sand or any other dry matter. The pores of the shell must not be stopped up, for normal respiration is necessary to the life of the germ contained in the egg. Sawdust and ashes when dry absorb moisture and cause loss of the watery contents through the shell. Sawdust is, however, used for packing eggs to be forwarded for hatching; in that case slightly dampened sawdust should be used, and after unpacking, the eggs should be let to stand for at least one day before being set for incubation.

Good Eggs.—The newest laid eggs are the best for hatching. They are known by their clear colour and the rough feeling of their shell, their gloss and the absence of an air space. When shaken in the hand, no movement of the contents is felt inside; finally, they sink in water.

Bad Eggs.—Any eggs which have not a clean shell, those with an uneven (fig. 21) (fig. 22) or very transparent shell (fig. 23-24) should be rejected; eggs either very large or very small, those known as coming from either sickly, overfat hens or poor layers are better laid aside for other purposes.

Fig. 21.

Fig. 22.

Fig. 23.

Fig. 24.

Precautions during Hatching.—Dirty eggs should be cleaned. The eggs must be kept quite clean the whole time of incubation. If the hen should dirty any during that time, wash them at once, and to do so wait till the hen is off at her meal; use for this

a small cloth or sponge dipped in luke-warm water. Such cleaning is absolutely necessary so as to allow fresh air to penetrate through the pores of the shell to renew the supply of oxygen, an element which is indispensable to the embryo as it gradually develops in the egg during incubation.

Eggs for hatching purposes should be collected every day, the name of the breed and the date being carefully written on the small end of the egg.

Natural Incubation.

Selection of Sitters.—A good sitting hen must be of gentle disposition, well feathered and in good condition, as the period of sitting is a trying one. Do not use hens that are easily frightened or such as have the bad habit of egg eating.

Setting.—The sitting hen must be in a rather dark place, which is quiet and away from the layers and the bad sitters. If you are obliged to change her to another nest or another place, do so in the evening so that she may be disturbed as little as possible.

Fig. 25.—Nest box for Sitting Hens.

A convenient nest is easily made with a box about fifteen inches square (fig. 25). B fore giving to a hen the eggs selected for hatching, it is best to place other eggs in the nest, and, if after she has had a meal, she goes back of herself to the nest, you can safely entrust them to her.

During the first days of the incubation it is better to keep the door of the box closed and to watch the hen when let out for her meals After three or four days the door may be left open sometimes, however, it is better to keep it closed.

If in a dry place, this box should rather be on the ground, the soil under it being a little hollowed out and covered with some straw, chaff or dry grass.

A good diet for the sitter is Indian corn and clear water (each by itself, of course), ever ready when the hen comes out of the nest.

Against lice, some blue ointment, made by mixing strong mercurial ointment with an equal weight of lard, should be applied to the skin of the sitter, as in the case of vermin, page ; or she should be dusted, as well as the nest, with insect powder.

A few tobacco leaf stalks placed under the straw of the nest of the sitter is a good preventive of vermin ; but too many might be injurious to the embryos of the hatching eggs.

Artificial Incubation.

It is certain that, when it is desired to get at the same time a hundred chickens or more, it is better to have recourse to artificial incubation, which has many advantages over natural incubation.

Advantages.—The incubator is ever ready ; it can contain a great many eggs ; no breaking is to be feared ; no bad smell ; no eggs dirtied ; no chicks crushed in hatching ; no vermin ; no sitter to be attended to, to clean every morning, and, especially, no sickness to which hens are liable during incubation, which sometimes causes serious loss. The care to be taken of sitting hens is more complicated and involves more labour than is necessary with an incubator.

The simplicity of a good machine is such that its care and management may be entrusted to any one with limited experience.

Hot Water Incubators.—In order to raise the temperature rapidly, fill up the tank with hot water; else it requires at least ten to twelve hours to reach a heat of 103 degrees F. After filling up the tank, draw a little water through the tap, so that it may not overflow when at the required temperature.

See that the machine be placed quite level.

Put the lamp in its place and keep it perfectly clean during all the time of the incubation.

The lever or regulator must remain closed; in other words, the lid at the end of the lever must stop up the opening until the inside temperature has reached 101 degrees F. Then adjust the regulator so that it raises the lid about one-tenth of an inch from the opening. After a few hours the eggs may be safely entrusted to the machine, and the next day, the regulator should be adjusted so as to bring up the temperature to 103 degrees F., and *keep* it at that point till the hatching takes place.

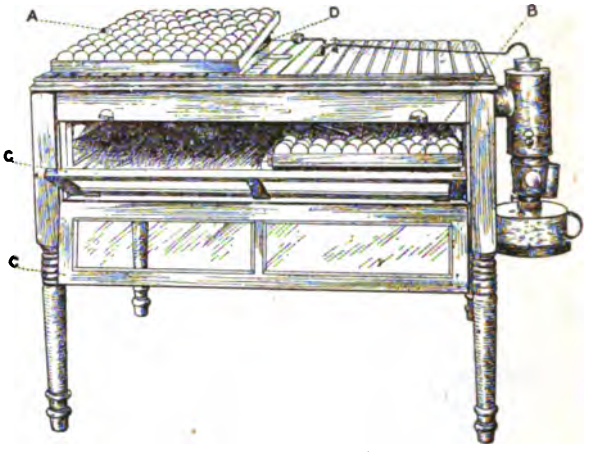


Fig. 26. Hot Water Incubator.

Hot-air Incubators.—For a hot-air machine, follow the same directions as above; but do not put any water in the tank.

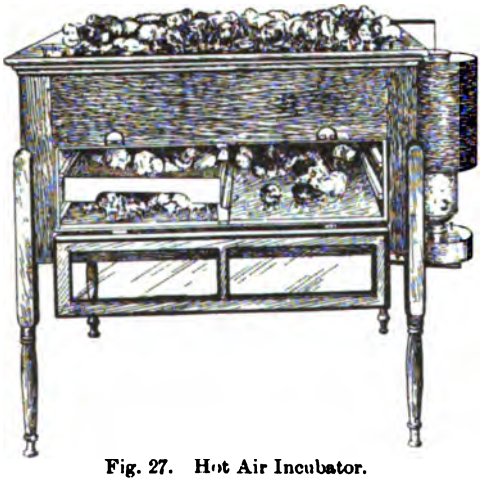


Fig. 27. Hot Air Incubator.

Fig. 27 shows a brood of chickens just hatched in a hot-air incubator at the Central Experimental Farm in April, 1905.

Position of the Eggs on the Trays.—Rest the eggs on their side, the large end resting on the meshes of the netting (fig. 26 A). A too strong inclination causes an upturning of the chick in the shell, or, more correctly expressed, an abnormal displacement of the embryo, which, in consequence of the position of the egg, goes down toward the small end, and when once adhering there, remains fixed while developing. Very often, on hatching, in such cases, especially if the egg is pointed, the chick has malformed legs or a twisted neck. The eggs are shown in position during incubation at fig 26.

Surroundings.—The room must be kept quite clean, and the incubator put on the ground floor, or in a dry clean cellar.

In poultry raising on a large scale, the floor of the incubator house should preferably be paved or of cement; it should be always covered with a layer of sand of at least two inches in thickness. The sand maintains dampness and deadens the noise of steps. Wherever the room may be, it must be quiet, without draught, with an even temperature, well ventilated and preferably dark.

Starting and Management of the Incubators.—In artificial incubation, it is essential that a close and intelligent imitation of nature be adhered to.

Without going into the directions laid down by the manufacturers of the machines, the method which has given the best results at the Experimental Farm with both hot-air and hot-water incubators will be briefly described.

A little attention to the lamp morning and evening is sufficient to keep it perfectly clean.

To prevent the lamp from smoking during each incubation, dip new wicks in vinegar for three or four hours, and let them dry thoroughly before using them. In this way, the smoking of lamps may be prevented.

Airing and Cooling.—Airing and cooling of the eggs is begun on the third day and stopped on the nineteenth; after the cooling, the eggs are turned very gently by hand. For this, the trays are laid on a table or on the machine. During all the time of the airing and cooling of the eggs, the doors *cc.* of the machine are left open. (Fig. 26.) The ventilators are kept half closed during the incubation and completely open during the hatching. After the ninetenth day, the door of the incubator is kept closed tight.

The time devoted each day to the airing and the turning over of the eggs varies according to the time of the incubation. The average is:—

For the 1st week—Fifteen minutes each day.
" 2nd " Thirty minutes.
" 3rd " Forty-five minutes.

Fig. 28.

Egg Testing.—The eggs must be tested on the fifth or sixth day of the incubation. Where only one or two sittings are to be tested this can be done by holding the egg in the hand half closed and placing it in front of the light of a candle. For a larger number of eggs, the testing is done more quickly and more easily by means of the egg tester. (Fig. 28.) This little instrument allows the inside of the egg to be seen nearly

as well as if there was no shell. The testing must be done in the dark. If the egg is fertilized the germ should be seen very distinctly as in (Figs. 29, 30, 31.)

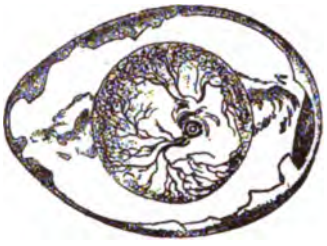


Fig 29.

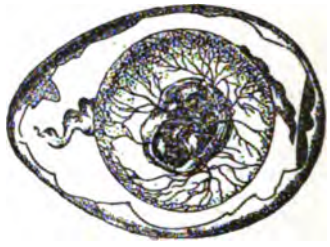


Fig 30.

Fig. 31.

If the egg is not fertilized, and is freshly laid, it is almost quite transparent and does not seem to contain any yolk. If not freshly laid, the yolk seems to float in the midst of the white as in (Fig. 32.) If the egg is fertilized and the germ has not enough vitality to develop, the germ will be seen surrounded with a circle or a half circle of blood as in (Fig. 33.) Such eggs should be rejected. The clear eggs are still excellent for eating or if desired for feeding chicks.

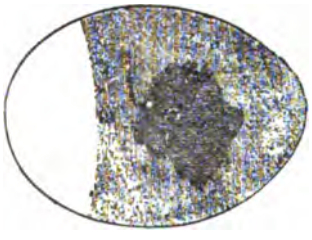


Fig. 32.

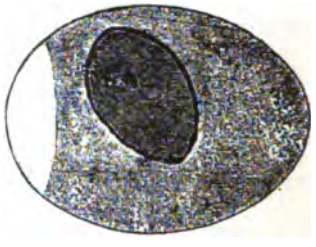


Fig. 33.

How Eggs are Tested.—Egg testing requires practice, and the beginner will some times throw away fertilized eggs.

While testing, the egg must be kept in a horizontal position, not with one of the ends downward before the egg-tester (A Fig. 28); this is sometimes a cause of mortality of the germ and certainly increases the percentage of deaths in the shell.

It is to be remembered that the germ is a delicate thing, for one single shock may break one of the minute elastic threads which holds the embryo in its place in the egg

The germ is held in place in each egg by two such threads. (*See Fig. 34*). When the egg is in an horizontal position both of these threads hold the germ in place and act evenly as elastic springs. Besides the yolk on the top of which the germ is floating, plays the part of a cushion and deadens the shock. But if the egg is turned with one end downward, one only of these elastic threads is supporting it. Under such circumstances the mere shaking of the hand of the operator may break it, and a living healthy egg is thus often returned dead into the machine after being tested. When an egg is to be tested, place towards the tester, (*Fig. 28*) that side which did not receive the heat when it rested on the tray in the incubator; the yolk, being lighter than the white, is thus nearer the upper wall of the egg and consequently is more easily seen.

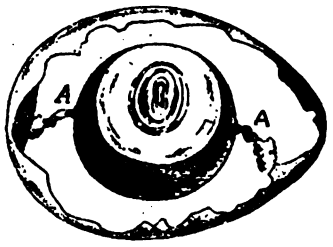


Fig. 34.

After the fifteenth day, nothing is distinguished any more in the egg but an opaque mass, quite dark, with a very transparent portion at the top, towards the thick end; this is the air space which at the end occupies nearly one fifth of the whole shell, (fig. 35).

Fig. 35.

Usefulness of Testing.—The usefulness of testing is that it enables us to fill up again the number of the eggs of a sitting which has been reduced by the removal of sterile eggs or dead germs, by taking eggs from other sittings set at the same time. Where five or six hens are sitting the number of fertile eggs is sometimes reduced sufficiently to admit of their being placed under three or four hens, thus releasing one or two hens for fresh sittings.

This manipulation is possible only when the hens have begun sitting on the same day or when several incubators have been started on the same date, otherwise there will be danger for those eggs which have not then reached the stage of incubation when the germs are sufficiently strong to be submitted to that degree of aeration and cooling beneficial to the others.

Usefulness of the Turning of the Eggs.—The necessity of turning the eggs once a day or both morning and evening, may be thus explained. If the egg was left in the same position, the embryo which floats always at the upper side of the egg, would probably before long adhere to the shell and soon die.

The eggs must be allowed to cool before being turned, otherwise the embryo, being always at the top where the heat is greatest, would probably remain stuck to the bottom when the egg has been turned, if it had not had the time during cooling to come up and float in the centre of the egg.

Dampness.—In ordinary conditions, the eggs contain sufficient moisture for the requirements of incubation. The experiments made at the Experimental Farm do not show at all clearly that any moisture should be added to the machines, that is, that there is any need of putting water in the tank or tanks of the machine. The proper airing and cooling of the eggs allow the oxygen of the air, indispensible to the chick in the shell, to penetrate the egg. In short, the management of an incubator presents no difficulty. Four things only are necessary.

1st. Keeping as evenly as possible the temperature at 103° F.

2nd. Airing, cooling and turning the eggs at least once a day.

3rd. Good ventilation of the incubating room and protection of the machine from the sun's rays.

4th. Both the lamps and machine must be kept all the time perfectly clean.

Hatching.—Hatching should begin on the twenty-first day. No help must be given the chicks by breaking the shell, which might be fatal to them. Nature is to be left to do the work. The chick does not break the shell with the beak, as is generally supposed. The shell is much harder than the beak, which in the egg is only a mere horny tip, still very soft. The neck of the chick is folded, its head close against its chest; therefore the chick cannot make the least movement in order to peck (fig. 36). It 'peeps'; feeble faint sounds are heard, that is all. It is true that the point of the shell which breaks first is mostly in front of the beak; but that is merely a provision of nature to allow the chick to fill up its lungs as soon as it is born to life. Thus strengthened, it exerts itself in every direction to break its prison. At the right moment the shell, weakened by the evaporation of its fluid constituents, as a result of its having been kept during the incubation period at a heat of 102 to 104 degrees, gives way and splits in a circle (fig. 37).

Fig. 36.

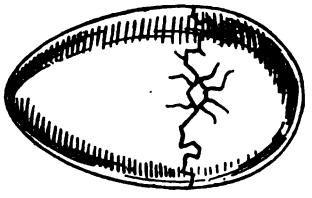


Fig. 37.

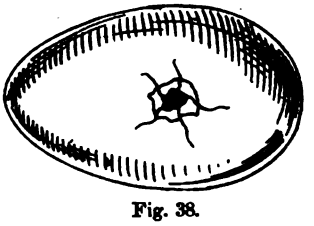


Fig. 38.

Eggs at hatching time roll upside down; a strong and vigorous chick moves with such force that it will free itself; but a weak one, instead of making the shell break all round, breaks only a little hole, through which the beak is to be seen (fig. 38), and often a bloody or watery liquid oozes out and sticks to the tray.

The incubator must not be opened during the hatching. A hen never gets off her eggs while the chicks are hatching.

After the chicks are hatched they must be given neither food nor drink for thirty-six hours, so that they may have time to digest part of the yolk with which their intestines are still filled; if they are fed before this time many die of indigestion. It is advisable to remove the chicks in the evening from the incubator into the brooder. The next morning they are ready to receive their first food.

The following tables are not given to show the results which can be expected from natural or artificial incubation, but simply to establish a comparison between the methods followed at the Central Experimental Farm; for in ordinary circumstances better results are to be expected, as the farmer has mostly only one breed or variety of poultry with an unlimited run. A large range is one of the chief factors in the vitality of the germ. The following figures quoted are the results of experiments conducted during the spring of 1904 with birds kept in warm houses, having had indeed plenty of exercise but kept penned up or in a limited run during all the time the eggs were collected for hatching.

A few particulars are now given as to the manner of handling the different incubators and the treatment of the eggs during incubation.

These details are those of experiments conducted after our own methods, independently of the directions given by the makers of the different machines.

The statements Nos. 1 and 2 were obtained with two similar machines.

No. 1 Test.—Prairie State Incubator. Hot Air.

Filled on February 20, 1904, with eggs in quality and kind as follows :—

Description of Eggs.	No. of Eggs.	Clear Eggs 1st Test.	Dead. Germs 16th day.	Chicks dead in Shell.	Chickens Hatched.
Silver Laced Wyandottes	20	3	7	2	8
Buff Orpingtons	14	3	8	3	0
Silver Grey Dorkings	14	2	8	0	4
Faverolles	12	2	3	4	3
White Wyandottes	9	2	7	0	0
Barred P. Rocks (No. 2 pen)	8	0	3	3	2
Black Hamburgs	7	3	4	0	0
White Plymouth Rocks	6	0	0	0	6
Total	90	15	40	12	23

Birds had all the same care and feeding.
Incubator was operated in the office, the atmosphere of which was very dry.
Variation of temperature in room during hatch was from 25 to 30 degrees.
No moisture was used in either machine or room.
Time of cooling the eggs was :—
1st week 10 to 12 minutes.
2nd week 15 to 20 minutes.
3rd week 25 to 30 minutes.
Door of incubator was left open during the cooling of the eggs.
Eggs were turned once per day after cooling.

Test No. 2.—Chatham 'Red Bird' Incubator--Hot Air.

Filled on February 27, 1904, with eggs as follows :—

Description of Eggs.	No. of Eggs.	Clear Eggs 1st Test.	Dead Germs 16th day.	Chicks dead in Shell.	Chickens Hatched.
Buff Orpingtons	16	4	5	2	5
Silver Grey Dorkings	16	1	8	3	4
Silver Laced Wyandottes	15	2	2	1	10
White Wyandottes	11	3	6	1	1
Faverolles	11	3	3	3	2
Barred P. Rocks	13	0	3	4	6
Black Hamburgs	8	2	6	0	0
Black Minorcas	5	1	4	0	0
White P. Rocks	5	2	2	1	0
Total	100	18	39	15	28

Birds were kept under same conditions with exception of Barred and White P. Rocks which were under experiment.
Incubators were placed in same office as No. 1.
Temperature of room and time of cooling the eggs same as No. 1.
Water was constantly kept in moisture pan.

TEST NO. 3.—CYPHER'S INCUBATOR (220-EGG SIZE). HOT AIR.

Filled on March 5, 1904, with following eggs :—

Description of Eggs.	No. of Eggs.	Broken by Accident.	Clear.	Dead Germs.	Dead in Shell.	Chickens Hatched.
Buff Orpingtons	43	4	8	13	5	13
White Wyandottes	32	2	12	9	2	7
Silver Grey Dorkings	27	0	5	18	1	3
White Leghorns	23	0	2	13	7	1
Barred P. Rocks	20	0	1	10	5	4
Black Minorcas	16	0	2	7	3	4
Rhode Island Reds	12	0	2	6	4	0
Faverolles	10	0	2	5	1	2
Silver Laced Wyandottes	16	0	1	3	2	10
Black Hamburgs	10	0	1	5	2	2
Jubilee Orpingtons	8	0	2	6	0	0
Buff Leghorns	7	2	1	1	0	3
White Plymouth Rocks	4	0	1	2	0	1
S. Spangled Hamburgs	2	0	0	2	0	0
Total	230	8	40	100	32	50

This incubator was placed in same office as Nos. 1 and 2, with similar variations of temperature.

Time of cooling eggs same as Nos. 1 and 2.

Test No. 4—Desmoines (Hot Water) Incubator. 260-Egg Size. Filled April 26, 1904.

This test and the following one was conducted in a new building erected after the fire previously referred to. The incubator was filled with the following eggs :—

Description of Eggs.	No. of Eggs.	Accidentally broken.	Clear.	Dead Germs.	Dead in Shell.	Chickens Hatched.
Barred P. Rocks	38	1	5	8	1	23
White Leghorns	45	2	5	5	3	30
B. P. R.—Bro-Leghorn Cross	22	0	8	1	0	13
Silver Grey Dorkings	21	0	8	1	0	12
White Wyandottes	18	0	3	2	1	12
Buff Orpingtons	14	0	5	4	1	4
White Plymouth Rocks	15	1	0	4	0	10
White Wyandotte Cross	14	0	0	3	0	11
Jubilee Orpingtons	9	0	0	2	0	7
Light Brahmas	10	1	2	1	1	5
Black Hamburgs	10	1	2	1	0	6
Silver Laced Wyandottes	5	0	0	0	0	5
Faverolles	6	0	2	0	1	3
Black Minorcas	3	0	0	0	0	3
S. Spangled Hamburgs	7	0	1	2	0	4
	237	6	41	34	8	148

No. of days.	Temp. of Room. A.M.	Temp. of Room. P.M.	Temp. of Incubator. A.M.	Temp. of Incubator. P.M.	Time of Cooling	Remarks.
1	52	58	92	102		
2	58	58	102	102		
3	57	67	102	102		
4	58	64	102	102	10 minutes.	1st cooling and turning a.m.
5	54	64	102	103	12 "	
6	60	80	103	103	12 "	1st test.
7	65	82	103	103	14 "	
8	52	85	103	103½	14 "	
9	56	80	102	103	15 "	
10	56	74	102	104	15 "	
11	61	84	103	104	15 "	
12	67	81	103	103	15 "	
13	66	87	102½	104	20 "	
14	59	78	102	103	30 "	
15	63	70	103	103	30 "	
16	55	75	103	103	30 "	
17	59	83	102½	103	30 "	Last test.
18	58	84	103	104	30 "	
19	67	61	103	103	35 "	Last cooling.
20	60	64	103	103		
21	56	78	103	103		

Eggs were turned twice per day, the first at cooling time and once afterwards.
Ventilators half open all the time.
Doors of the incubator were left open all the time of cooling.
No moisture was used in machine.

Test No. 5.—Cypher's Incubator (220-Egg Size). Hot Air.

Filled on May 14, 1904, with following Eggs. Machine was operated in new building for reason explained in No. 4.

Description of Eggs.	No. of Eggs.	Clear Eggs.	Dead Germs.	Dead in Shell.	Chickens Hatched.	Days.	Temp. of Room.		Temp. of Incubator.		Time of Cooling Eggs.	Remarks.
							A.M.	P.M.	A.M.	P.M.		
Barred P. Rocks	31	14	0	2	15	1	.....	84	.....	103		
Buff Orpingtons	26	5	3	1	17	2	67	61	103	103		
White Plymouth Rocks	21	0	5	4	12	3	60	64	103	103		
Black Hamburgs	15	2	5	4	4	4	56	78	103	104¼	15 minutes.	1st cooling of eggs.
B. P. R.—Brown Leghorn Cross	16	5	1	0	10	5	57	78	103	103	25 "	
White Wyandottes	15	8	1	2	4	6	60	65	103	103	25 "	1st test.
Silver-Laced Wyandottes	12	3	3	1	5	7	62	72	104	103	25 "	
Faverolles	11	4	2	2	3	8	63	84	104	103	30 "	
White Leghorns	14	1	3	1	9	9	68	67	103	103	30 "	
Light Brahmas	11	5	4	1	1	10	66	76	103	103	30 "	
Black Minorcas	7	1	1	1	4	11	69	88	104	104	30 "	
S. Spangled Hamburgs	7	2	4	0	1	12	70	72	104	103½	28 "	
Buff P. Rocks	5	0	1	1	3	13	68	83	104	103	45 "	
Silver Grey Dorkings	9	2	0	1	6	14	66	84	103	103	45 "	
						15	56	76	104	103½	45 "	
Total	200	52	33	21	94	16	58	78	103½	103½	40 "	Last time of testing.
						17	60	76	103½	103	45 "	
						18	54	71	103	103	45 "	
Eggs were turned twice per day.						19	60	39	102	103	45 "	Last time of cooling.
Ventilators half open all the time.						20	60	71	103	103½		
During the time of cooling eggs the incubator doors were left open.						21	71	76	103	103		

TEST No. 6.—FOUR HENS AS HATCHING MEDIUMS.

On April 20, 1904, they were given 13 eggs each of the following kinds :—

Description of Eggs.	No. of Eggs.	Clear.	Dead Chicks in Shell.	Chickens Hatched.
S. G. Dorkings	8	3	0	5
White Leghorns	8	0	3	5
B. P. R.—Brown Leghorn Cross	4	1	0	3
Black Hamburgs	3	0	0	3
Buff Orpingtons	3	0	0	3
White Wyandottes	5	1	0	4
Barred P. Rocks	5	1	0	4
Faverolles	3	0	0	3
Jubilee Orpingtons	3	1	1	1
White Plymouth Rocks	2	0	0	2
S. Spangled Hamburgs	2	0	0	2
Buff Plymouth Rocks	2	0	0	2
Light Brahmas	1	1	0	0
Black Minorcas	3	1	0	2
Total	52	9	4	39

TEST No. 7.—In which a number of hens were used as hatching mediums. They were set at different times during May, 1904, on the following eggs :—

Date when set.	Description of Eggs.	No. of Eggs set.	Clear.	Dead Germs.	Dead Chicks in Shell.	Chickens Hatched.
1904.						
May 2..	Light Brahmas	10	2	0	2	6
" 5...	Buff Leghorns	36	10	1	1	24
" 5...	Black Minorcas	52	10	8	10	24
" 7.	White Wyandottes	60	17	5	6	32
" 14...	S. G. Dorkings	15	3	2	3	7
" 14...	Faverolles	15	3	1	1	10
	Total	188	45	17	23	103

The number of clear eggs on May 2, 5 and 7, goes to show that the birds, in the latter part of the month of April when the eggs were collected, had not completely recovered from the effects of the fire which occurred on the 8th of the latter month. Later, the percentage of clear eggs, it will be noticed, is very much less.

CAUSES OF THE NON-FERTILIZATION OF THE EGGS.—It is often a matter of surprise to find, when testing the eggs, that from fifty to sixty or more out of a hundred are clear.

There are many causes of the non-fertilization of the eggs :—

(1.) Overfat state of the breeders—one of the chief causes.

(2.) Lack of exercise.

(3.) Sudden changes in temperature.

(4.) Too many or too few hens for one cock. In a small run, ten to fifteen hens suffice; but when running at large, from twenty to thirty-five are not too many, depending on the vigour of the breed.

(5.) The age of the cock; when over four years old, he is no more able to fertilize as large a number of hens.

(6.) Unhealthy and insufficient food.

(7.) The dirty and unhealthy state of poultry-house and yard.

These are the commonest reasons for lack of vitality in the eggs.

In a run which is too damp or too small, hens deprived of green plants and insects will lay eggs many of them clear, even if mated with a strong male bird, because without being apparently sick they are not by any means in robust health.

MORTALITY IN THE SHELL.—Many breeders, especially beginners, lay down this as a principle. The egg is fertilized, therefore it will hatch. This is a great mistake. As a rule, for those who are hatching their eggs artificially they often think that the incubator is at fault. No doubt, in many cases, the fault is with the incubator; but sometimes the fault is with the breeder.

There are indeed several causes of the mortality in the shell. One as already explained is in the way of testing the eggs; but the chief one and the most serious, is the weakness of the germ, a result of the poor care taken of the breeders. This is an essential point.

The percentage of weak germs in the shell is especially high in the eggs of birds that have a limited run. If well fertilized eggs are wanted, the food of the layers must be of good quality. During the breeding season, it is better to reduce considerably the soft rations and to feed good grain, preferably a mixture of wheat, buckwheat and oats.

Mouldy or fermented grain may be a direct cause of disease of the intestines of fowls, which may then be communicated to the egg.

Scrubby, weak or sickly stock is what gives the largest percentage of mortality in the shell.

CAN THE SEX OF THE CHICK BE FORETOLD?—We are some times asked: 'Please send me eggs of such and such a shape, for I want to raise only cockerels, or only pullets.'

It is impossible to foretell the sex of a chick not yet hatched, though certain circumstances may affect the production of a large number of birds of either sex.

Eggs collected in the early part of the season have usually given more males than females; also, when a cock had only a very limited number of hens to fertilize. The reason is that the cock in spring is in his full vigor, but becomes less vigorous as the season advances.

If the male parent is old and the females young more hens than cocks will be had; the contrary is true if the cock is young and the hens old.

As to the shape of the egg it varies according to the age of the layers; thus, the eggs of pullets are smaller and more pointed than those of old hens.

Long and pointed eggs do not give any more males than round ones.

Some say that an egg produces a cock if its crown or air space is horizontal; a hen if it is oblique, that is, slanting. In our experience we have not found such results.

HOW LONG DOES THE EFFECT OF FERTILIZATION LAST.

Two interesting experiments, particulars of which are given in the two following tables, were made at the conclusion of the breeding season last summer. The objects aimed at were:—

1. To find out how long after the removal of the male bird from the breeding stock was fertilization strong enough to hatch out a healthy chicken.

2. How long after the removal of the male bird could the effect of fertilization be traced?

The questions are answered by the results in the following tests 8 and 9.

TEST No. 8.—With seven Barred P. Rock hens from which the male bird was separated on June 29, 1904. On the same day eggs were put into an incubator and thereafter, from time to time during twenty days. Details are :—

Date.		No. of days male bird separated from hens.	No. of eggs set.	Clear eggs. — 1st test.	Dead germs.	Dead in shell.	Chickens hatched out.	Remarks.
1904.								
June	29.	.....	3	1	1	.....	1	Strong chicken.
"	30..	1	1	1	.....	.....	.....	No results from this egg as it was clear.
July	1..	2	3	1	.....	.....	2	Strong chicken.
"	2..	3	3	1	...	...	2	"
"	3..	4	2	1	...	...	1	Weak chicken.
"	4..	5	2	1	...	.....	1	Healthy chicken.
"	5..	6	3	1	.....	.....	2	"
"	6..	7	1	1	...	.....	.....	Egg without germ ; no result.
"	7..	8	1	..	1	.....	.....	Germ dead from weakness.
"	8..	9	1	1	...	.....	.....	Egg not fertilized ; no result.
"	9..	10	1	.....	.....	1	..	Chicken partly developed ; dead from weakness.
"	10..	11	.....	.....	.....	.....	.....	No eggs laid this day.
"	11..	12	1		...	1	.....	Chicken dead in shell evidently from weakness.
"	12..	13	1	1	...	.....	.....	Egg without germ ; no result.
"	13..	14	.....	.....	.....	...	...	No egg laid this day.
"	14..	15	2	2	...	.....	.	Eggs without germs ; no results.
"	15..	16	1	1	.....	.....	.....	" "
"	16..	17	2	2	...	...	.....	" "
"	17..	18	.....	.....	...	.....	.....	No eggs laid this day.
"	18..	19	1	1	...	.....	..	Eggs without germs ; no results.
"	19..	20	1	1	.....	.....	.....	" "
"	20..	21	1	1	..	...	.....	" "
			31	18	2	2	9	

TEST No. 9.—With five White Leghorn hens. Cock bird separated from hens on June 23, 1904. Eggs put into incubator five days later and thereafter for twenty days. Details are as follows :—

Date.		No. of days male bird separated from hens.	No. of eggs set.	Clear eggs. — 1st test.	Dead germs.	Dead in shell.	Chickens hatched out.	Remarks.
1904.								
June	28..	5	4	2	.....	...	2	Strong chickens. Eggs laid 5 days after removal of male bird from hens.
"	29..	6	3	1	1	....	1	Strong chicken.
"	30..	7	4	1	.....	....	3	Strong, healthy chickens. Male bird away from hens seven days.
July	1..	8	2	.....	.....	1	1	Strong, healthy chick. Male bird away from hens eight days.
"	2..	9	3	.....	....	...	3	Chickens weak ; had to be helped out of shells.
"	3..	10	2	.....	.....	.....	2	Fairly strong and healthy. Male bird away from hens ten days.
"	4..	11	3	2	.....	.....	1	Weak and infirm. Male bird away from hens eleven days.
"	5..	12	1	1	.....	.....	.....	Egg without germ. No eggs with germs after this date.
"	6..	13	2	2	...	.....	...	Eggs without germ.
"	7..	14	2	2	.....	....	..	"
"	8..	15	1	1	.....	..	...	"
"	9..	16	2	2	.....	..	.....	"
"	10..	17	....	.....	...	.....	.....	No eggs laid this day.
"	11..	18	.....	.....	.....	.....	.....	"
"	12..	19	1	1	.....	..	.....	No germ in egg.
"	13..	20	1	1	...	...	.....	"
"	14..	21	1	1	...	.....	....	"
"	15..	22	1	1	.....	.....	....	"
"	16..	23	3	3	....		.....	"
"	17..	24	1	1	...	.....	...	"
"	18..	25	3	3	...	.....	.....	
			40	25	1	1	13	

It is interesting to note the result of the two tests. In the first test, No. 8, fertilization was strong enough in 6 eggs laid on the 5th day, after removal of the male bird from the breeding pen, to hatch out two healthy chickens. The last trace of fertilization is found in an egg laid eleven days after removal of the male bird. Examination of this egg, in course of incubution, showed a fairly well developed chicken dead in the shell. It had evidently died in progress of development from weak germination. No further evidence of fertilization was found in this test.

In the second case, test No. 9, strong chickens are hatched from eggs laid on the eighth day after removal of the male bird and fairly strong and healthy chick from eggs laid on the tenth day after separation. From the three eggs laid on the eleventh day after separation a weak and infirm chicken was hatched. After this there was no trace of fertilization.

Another interesting result which made itself evident was the comparative unimpaired condition of the unfertilized eggs at the conclusion of the 21 days' tests. These unfertilized eggs were taken from the incubator on the 22nd day, after they were put into the machine. During that time they were subject to the ordinary temperature of 103 degrees of heat usually maintained for the hatching of chickens from fertilized eggs. On examination, these unfertilized eggs were found to be in as equally good condition and flavour—if not better in some instances—than the majority of midsummer eggs. This strongly emphasizes the advice so frequently given in previous reports and repeated in a previous page of this one—'that farmers should make it a rule to keep no male bird with the hens which lay the eggs to be taken to market, or sold to

store or middleman.' This experience in relation to the superior keeping qualities of unfertilized eggs is by no means a new one in our department. On the occasion of the two tests described above there was good opportunity for extended and correct examination, and the results which were so evident in so many cases, not only go to prove the correctness of previous advice, but should be a useful warning to all who are desirous of obtaining the highest price 'for the strictly new laid egg with flavour intact,' more particularly in summer time when conditions for germ development are so favourable.

Time required for Fertilization.—A question which has, no doubt, some importance in hatching eggs is to know the time required after mating for fertilization. Experiments made during the spring of 1905, in this connection, showed that in each case eggs laid forty hours after mating were perfectly fertilized. The chickens hatched from such eggs were always as strong as those from eggs laid a longer time after the first mating.

How many Hens should be allowed to one Cock?—Another important question is the number of hens to be allowed to one cock in order to obtain eggs satisfactorily fertilized. No figure can be set for all cases; but a sure fact is that the closer the confinement of the breeding stock, the less satisfactory will be the result. On the contrary, a large and free run in the open air promotes the generative power more probably in the male than in the female. The same is true of birds kept in warm winter quarters, with little exercise and without fresh air. On the contrary, those kept in a cold, well ventilated building, and constantly active, scratching for their food, will produce a larger proportion of well fertilized eggs.

As a rule, a cock which has attained the standard weight of his breed and has an unlimited run, may be safely given from twenty to thirty-five hens; while in a small run, half of this number would be sufficient. In confirmation of these facts, there are instances which have recently been brought to my attention by outside breeders. In the first case, one cock which was kept with twelve hens all winter in a heated house, with but little space and exercise, and confined during the whole time of breeding. Out of forty-eight eggs set in the incubator on March 21, 1905, twenty-eight were clear and only twenty fertilized; of the latter ten hatched, the others died during the incubation or at the pipping stage.

In another case, one cock with forty-five hens, kept in a very cold house (so cold that several of the hens were frozen), taking much exercise and in the fresh air, in the scratching pen and running at large during the breeding season. Out of one hundred and fifty-six eggs set in the incubator at the same date, one hundred and fifteen were fertilized, and ninety-four chickens hatched. The food was alike in both cases.

In another incubation, one month later, on April 20, 1905, from the same fowls, out of two hundred and four eggs, sixty were clear, one hundred and six hatched, seven died before the period of hatching, and thirty-one died in the shell.

These results serve to show that a cock at liberty has not too many with about thirty hens.

Suspension of Life in Chicks during Incubation.—M. Bouchut, of the Paris Academy of Sciences, used some eggs in incubation to show that the entire cessation of the beating of the heart does not take place even when there seems to be a cessation of life. In such cases there is merely a decrease in the number and the energy of the pulsations.

"If hen eggs,' M. Bouchut says, "are removed from an incubator or from under a sitter after three days of incubation, the pulsations of the heart are seen to become slower in the egg and finally become so rare that it might be believed that they have altogether stopped, and as if life had left the embryo. The heart ceases beating usually after the twenty fourth hour from the cooling. If then the egg is placed in luke warm water the heart begins again to beat."

I have myself observed the same phenomenon; but, instead of plunging the egg in lukewarm water, I placed it again under the sitter or in the machine.

In experiments conducted some years ago, during the month of May, I found that a setting of thirteen eggs, placed under a hen, were after six days of incubation left to

themselves for thirty hours and cooled; they were then placed again under another sitter, when ten strong chicks hatched on the twenty-second day of incubation.

On a second occasion, on the eighth day of incubation the lamp of the incubator was left out for thirty-six hours, when the temperature was raised again to the usual point (103 degrees F.). The hatching took place in a satisfactory manner, and the result was just as good as in ordinary cases; the only difference was the loss of one day in incubation.

These facts show that, if similar accidents happen during incubation, there is no cause for excessive alarm, nor should the eggs be rejected as of no value for further incubation.

Poultry Raising.

Land for Raising Chickens.—The ground may vary in size, according to the number of birds to be raised, but it must be spacious and well fenced in.

It is desirable that the soil be of a sandy nature, but any sort of soil will serve the purpose provided it is not marshy.

An orchard makes the most suitable ground, because the four chief requirements are always met there: space, shade, grass and insects. Whatever be the ground, if there are no shrubs, some should be planted, so that the chickens may find shade when they feel the need of it.

Fig. 39. Brooding coop, C. E. F., Ottawa.

Fig. 40. A Brooding coop with a small run for the mother, Central Experimental Farm, Ottawa

Care of the Brooding Hen.—When the chicks are hatched, they are conveyed with the mother hen to a coop set on the grass. The hen is first placed in her compartment (Fig. 39), then the chicks are gently put under her. The mash must be placed quite close to the hen, so that she need not get up to eat it.

Unless it is very hot weather, the chicks will remain nearly the whole time under the mother.

Food, warmth, and cleanliness are the essential conditions in the raising of chickens.

For the first two weeks, the mother must be kept shut in under coop and run (Fig. 40.) In this way the chicks can come out and eat, and run about on the grass or go back when they wish to warm themselves under their mother.

Brooder or Artificial Mother.—The brooder is an apparatus destined to replace the mother hen in the rearing of the chicks. The modern brooders are nearly all well adapted for the purpose; therefore, in raising chickens on a large scale, success is much more certain by the use of such brooder than by using hens.

A brooder is a large square box divided into two compartments, at one end is an artificial mother. The floor is covered with a thin layer of sand or fine straw. The chicks receive the heat from the upper part of the apparatus which is made of galvanized iron.

The size and shape of the brooder and of the heating apparatus may be varied as desired.

During the first days the inside temperature of the brooder must be maintained between 85 and 90 degrees F., and gradually reduced as the chickens grow and thrive. The brooder must be cleaned every morning.

When the weather is warm and the chicks begin to get their feathers, that is, when about four or five weeks old, it is no more necessary to heat the brooder with the lamp, the animal heat is sufficient.

Care of the Chicks.—During the first twenty-four or thirty hours they should not receive any food and no water to drink for the first three days, these are two essential conditions for their health. The giving them rest is no less important, the chick, either in the brooder or under its mother, should be resting at least twenty to twenty-five minutes of every hour during the first six or seven days. To make the chicks rest in the brooder, they must be compelled to go into it, where they are kept in comparative

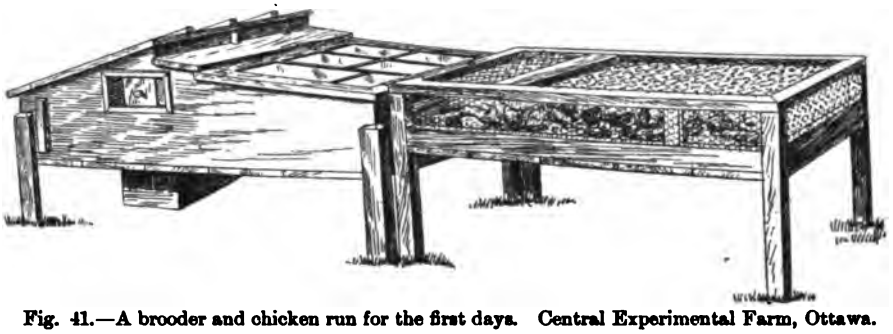


Fig. 41.—A brooder and chicken run for the first days. Central Experimental Farm, Ottawa.

darkness by raising the door between the brooder and the scratching or feeding compartment. After six or seven days one hour of rest in the forenoon and one in the afternoon are sufficient.

During the first days the chicks should be taken out for a short time in a little enclosed run (fig. 42.) A few minutes only at first and then again in the same way an hour later. With a brooder resting on the ground itself, the run can be made without any floor.

After the chicks have thus been taken out a few times, they will all soon know very well the door of their brooder; then a netting or boards may be arranged around the brooder (fig. 41) so that they may benefit by running about on the grass; then the most difficult part in the raising will be over.

When the feathers of the tails and wings begin to grow, the chicks require more care; they must not be left in a damp place nor be allowed to run about with the mother among grass covered with dew or rain; they must be taken in sooner than usual

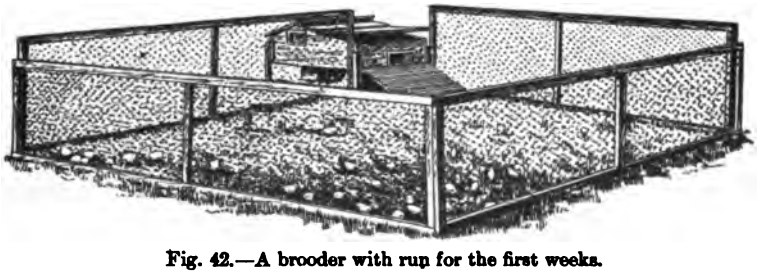


Fig. 42.—A brooder with run for the first weeks.

in the evening and be well fed. When the feathers of the tail and wings are beginning to show, the chicks are nearly safe; they can then be left free in the poultry yard with their mother or their brooder, care being taken not to leave them in the rain, for rain and dew are always injurious to them.

It is best to separate the cockerels from the pullets when they are two months to two and a half old.

Cockerels destined to be fattened may be kept in close quarters. Pullets that are intended for layers, should be kept in small colonies of forty to fifty in each run with a little colony house for protection. (Fig. 53, 54 and 55).

Food.—Especially in artificial raising, a common bad habit is to give too much food to the chicks, and pleasure is found in seeing them with their crop well filled up. This is a mistake, a chick during the first few days needs much more heat than food.

During this time, therefore, the chicks must receive as food nothing but mash composed of hard-boiled eggs, bread crumbs, &c., preferably soaked in milk, and well drained by pressing in the hand. A little later, add to the mash oat meal, bran, midlings, corn meal or cooked potatoes. When the chicks are about three weeks old a few crushed wheat or corn kernels are given. the quantity being increased as they grow. In order to excite the appetite of all, the food must be varied. When seven to eight weeks old, they may be fed twice a day, in the morning and the evening, a mixture of good grain such as wheat, crushed corn, oats, buckwheat, &c. They should be fed in moderate quantity not more than they can eat up clean. Whenever mash or grain is left in the little troughs or on the feeding place half an hour after the meal, it is evident that too much has been given; the ration must then be reduced.

Chickens, like human beings, enjoy food varied from day to day.

The food must be given often and little at a time. Water must always be fresh and clean. Food should be given in small flat wooden troughs. The most suitable are provided with a lid and pierced with side openings, so that it is impossible for the chickens to go in and soil the food, which at the same time is sheltered from the rain.

Chicks reared in an enclosed run must be fed a certain amount of animal and vegetable food, lime and fine grit.

FLESHING CHICKENS AND FATTENING OLD HENS.

SOME OF WHICH WERE LOOSE IN PENS WITH LIMITED RUN AND OTHERS IN CRATES.

The experimental fleshing of chickens and fattening of old hens, during the past season, were conducted by our poultry department. Details are given in following pages. The terms 'fleshing' and 'fattening' are used with intent, for experience has shown, that rations which are calculated to—and really do—go into 'flesh,' in the case of chickens, are frequently found in the shape of 'fat' in old hens. Experience has also shown that while flesh is desirable, fat—particularly that of old hens—is simply waste. The accumulation of fat in old hens doubtless makes increased weight and may mean a little more money to the seller, but, it is certainly loss to the purchaser, for, it is of no value to him whatever.

On the present occasion, hens of two years of age and chickens of two and three months old, were used.

The experimental fleshing of chickens in our department for several years has shown that before the best specimens can be produced the following preliminary conditions must be thoroughly understood, viz.:—

1. Chickens intended for fleshing should be of correct market types, such as can only come from the utility breeds. Hence the necessity of the parent stock being of proper breed and type.

2. Chickens should be well cared for and properly fed from time of hatching until put into pen or crate for 'finishing.'

3. The better the condition of the chickens when put into pen or crate to flesh the quicker and more complete will the 'finishing' process be.

4. Chickens which have been permitted 'to pick up their own living,' take more food, a longer period to flesh, and in the end seldom make specimens that will bring the highest price.

Attention to the foregoing points will certainly bring about the best results.

In the following experiment of Pen *vs.* Crate, the chickens were in five groups and the hens in one.

Each chicken and hen had a distinguishing number on a metal band round one of its legs.

Except where described the cross-bred chickens were of the ordinary barn-yard type.

The birds were fed twice per day and the rations were made of the consistency of thin porridge..

DETAILS OF EXPERIMENT in Fleshing Chickens in Pens and Crates. August 19, 1904.

Pen or Crate.	No. of leg band on Chicken.	Breed.	Cockerel or pullet.	Age. Months.	Age. Days.	Weight. Beginning of Experiment. Lb.	Oz.	1st Week. Lb.	Oz.	2nd Week. Lb.	Oz.	3rd Week. Lb.	Oz.	4th Week. Lb.	Oz.	Average at beginning of Experiment. Lb.	Oz.	Average at close of Experiment. Lb.	Oz.	Average total gain by chicken in 4 weeks. Lb.	Oz.	Average gain by chicken in 1 week. Lb.	Oz.
Group No. 1.																							
Pen.	16	B. Ply. Rock	C	3	14	3	15	4	11½	5	6	5	14½	6	1								
"	25	" ..	C	3	14	4	5	4	14½	5	10	6	1	6	6								
"	37	" ..	C	3	4	3	7	3	12	4	1	4	5	4	9½								
"	52	" ..	C	3	19	4	14	5	7	6	0	6	8	6	11	4	1 11/12	5	14 5/12	1	12½	0	7⅛
"	62	" ..	C	3	4	3	9½	3	15½	4	10	5	1½	5	8								
"	72	" ..	C	3	19	4	9	4	15	5	9	5	14	6	3								
Group No. 2.																							
Crate.....	20	B. Ply. Rock	C	3	14	4	11	5	1	5	8	5	15	6	1								
"	21	" ..	C	3	4	3	5	4	0	4	3½	4	7	4	12								
"	31	" ..	C	3	4	3	1	3	10	4	5	4	15	5	2								
"	63	" ..	C	3	14	3	8	4	0½	5	0	5	9½	5	15	3	13⅛	5	8	1	10⅝	0	6 17/24
"	86	" ..	C	3	14	4	1	4	5½	4	11½	4	15½	5	3½								
"	95	" ..	C	3	14	4	5	4	14½	5	2½	5	10	5	14½								
Group No. 3.																							
Pen.....	91	Crosses.....	C	3	14	3	4	3	12½	3	12½	4	11	5	0								
"	23	"	C	3	14	3	7	3	15½	3	15½	4	11	5	0								
"	29	"	P	3	0	2	5	2	12	2	15	3	3	3	3½								
"	35	"	P	3	4	2	12	3	5	3	5	4	0	4	6	3	½	4	9 1/12	1	8 7/12	0	6 7/24
"	64	" ..	P	3	14	3	0	3	8	4	1	4	5	4	9								
"	66	"	C	3	14	3	7	4	0	4	10½	5	0	5	4								
Group No. 4.																							
Crate	18	Crosses.....	C	3	14	3	2	3	5½	3	10	3	14½	4	1½								
"	21	"	C	3	4	2	14½	3	6	3	14½	4	4	4	7½								
"	40	"	P	3	4	2	13	3	3	3	11½	3	14	3	14								
"	68	"	P	3	14	3	7	3	14½	4	6	4	11	4	12½	3	1¾	4	5⅛	1	3 5/12	0	4 11/24
"	87	"	P	3	14	3	1	3	3½	3	8	3	10	3	10½								
"	91	"	C	3	14	3	5	3	13	4	5½	4	14	5	1								

CHICKENS *vs.* HENS IN PEN.

Pen or Crate.	No. of leg band on Chicken or Hen.	Breed.	Cockerel, Pullet or Hen.	Age. Months.	Age. Days.	Weight. Beginning of Experiment. Lb.	Oz.	1st Week. Lb.	Oz.	2nd Week. Lb.	Oz.	3rd Week. Lb.	Oz.	4th Week. Lb.	Oz.	Average at beginning of Experiment. Lb.	Oz.	Average at close of Experiment. Lb.	Oz.	Average total gain by chicken in 4 weeks. Lb.	Oz.	Average gain by chicken in 1 week. Lb.	Oz.
Group No. 5.																							
Pen	19	B. P. Rock.	C	2	29	2	10	3	1	3	12	4	0	4	3								
"	20	" ..	C	2	29	2	12	3	2	3	6	4	5	4	11								
"	29	" ..	C	3	4	3	9	3	14	4	7	4	13	4	15								
"	32	" ..	C	2	29	2	13	3	7	4	2	4	8	4	12								
"	99	" ..	C	3	4	3	11	4	3	5	0	5	7	5	9								
"	50	Cross Wh. Wy. & B.L.	C	2	4	2	1	2	8	2	14	3	5	3	9	2	10	4	5	1	11	0	6¾
"	72	" ..	C	2	4	1	14	2	5	2	15	3	5	3	8								
"	28	S. L. Wy...	C	2	16	2	8	2	14	3	7	3	13	4	2								
"	42	Buff Orp...	C	2	16	2	4	2	11	3	6	3	14	4	3								
"	87	W.W.&B.L.	C	2	16	2	6	2	12	3	5	3	11	3	14								
Group No. 6.		*Hens.*																					
Pen.....	23	Buff Orp....	H	2	years.	6	6	7	2	7	10	7	13	8	0								
"	27	"	H	2	"	5	2	6	2	6	6	6	9	6	13								
"	38	R. I. R.....	H	2	"	4	11	5	1	5	14	6	4	6	5								
"	90	"	H	2	"	5	4	5	15	3	5	6	9	6	9								
"	11	B. P. R...	H	2	"	5	12	6	1	5	15	5	12	5	8								
"	17	"	H	2	"	8	4	8	10	9	2	9	10	9	12								
"	1	W. P. R....	H	2	"	5	7	5	14	6	2	6	3	6	3	5	8 3/16	6	10	1	1 7/16	0	4 11/16
"	9	"	H	2	"	5	5	6	6	6	6	6	4	6	2								
"	58	Cross Wh. Wy. & Br. Leg.	H	1	"	5	1	5	15	6	2	6	2	6	1								
"	64	"	H	1	"	4	8	4	11	4	14	5	0	4	15								

Summary of Results, Pen vs. Crate. Weight, Development, Cost of Production, Profit from Sale, &c.

Group No.	Pen or crate.	Number of Chickens.	Weight. At beginning of experiment.		Weight. At close of experiment.		Total increase in four weeks.		Cost of Production. Chickens. Initial Weight.		Cost of Production. Chickens. Value at 10c. per lb.	Cost of Production. Food. Amount consumed in 4 weeks.	Cost of Production. Food. Value at 1¼c. per lb.	Cost to produce one pound of increase.	Total cost of production.	Returns from sale at 13c. per lb.	Profit on six chickens. Labour not counted.	—
			Lb.	Oz.	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.	$ cts.	Lb.	Cts.	Cts.	$ cts.	$ cts.	$ cts.	
																		Rations for 1 and 2 Groups.
1	Pen.	6	24	11	35	6	10	11	24	11	2.47	39	49	4½	2.96	4.60	1.64	Ground oats, 2 parts; ground barley, 1 part; corn meal, 1 part; mixed with skimmed milk.
2	Crate.	6	22	15	33	0	10	1	22	15	2.29	39	49	4½	2.78	4.29	1.51	
																		Rations for Groups 3 and 4.
3	Pen.	6	18	3	27	6	9	3	18	3	1.82	36	45	4 9/10	2.27	3.56	1.29	Ground oats, 4 parts; ground barley, 2 parts; ground corn, 1 part; meat meal, 1 part; mixed with skimmed milk.
4	Crate.	6	18	10	25	15	7	5	18	10	1.86	36	45	6 1/10	2.31	3.37	1.06	
																		Rations for Groups 5 and 6.
5	Pen.	10	26	8	43	4	16	12	26	8	2.65	58	73	4⅛	3.38	5.62	2·24	Finely ground oats, 4 parts; ground peas, 1 part; ground corn, 1 part; meat meal, 1 part, mixed with skim milk.
6	"	10	55	3	66	4	11	1	55	3	5.52	54	68	6⅛	6.20	8.61	2.41	

Results of the foregoing experiments permit of the following deductions :—

The pullets with one exception did not make as great gains as cockerels of the same age.

Old hens which are well fed require no further treatment to make them fit for killing.

The older the hen the more readily does she take on fat rather than flesh.

The cross-bred chickens, although fed on a more nutritive ration, did not make as much weight as pure bred ones.

The chickens which were loose in their pens with limited run, made slightly greater weight developments, at cheaper cost, than those in crates.

Poultry Buildings.

The construction of poultry houses varies much, first as to the materials used, then as to their size, shape and arrangements. For a farm poultry house, the arrangements and plans contained in this bulletin may not always be convenient to follow, but the general principles of their construction must always be the same.

In order that the fowls may enjoy the sunlight, the poultry house must have a southerly exposure. This point should not be overlooked, for a proper exposure is as necessary for the health of the fowls as suitable food.

Whatever be the shape decided upon, the poultry house must always be above the level of the ground in order to avoid dampness, which is so injurious to poultry.

It would be impossible to keep hens in cleanliness and health on a damp soil.

The farm poultry house may be built cheaply by using materials of low value in their construction.

The floor may be made of cement with a slight slope, so that it may be easily washed, or it may be made of small stones covered with sand, this latter being kept frequently raked. A cement floor is more easily kept clean, if covered with a thin layer of sand or with from four or six inches of litter, it has not, as some breeders assert, the fault of being cold for the feet of the hens. Besides, it has the advantage of being proof against vermin.

Of all wooden floors, a tarred floor is best, made of boards tarred on each side.

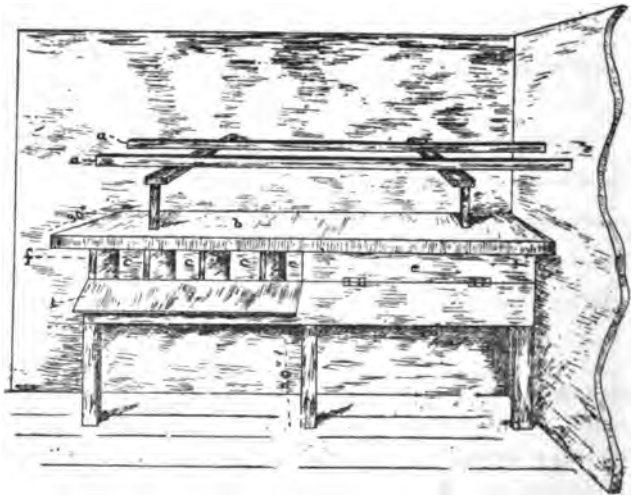


Fig. 43.

General Management.—The health of the fowls should be the first consideration. To ensure health the house must be well kept, clean, dry and well ventilated. If these essential points are neglected the keeping of poultry is likely to result in loss. Neglect-

ed houses are sometimes met with where vermin swarm and where neither chicks nor hens can make healthy growth.

Ventilation must be adequate and in proportion to the size of the building and the number of fowls sleeping in the building. Each chamber must have a system of ventilation working so as to carry away all the air rendered foul by breathing.

These ventilators may be flues, self regulating window ventilators (see fig. 43), or sliding panes at the bottom and at the top of the main window sash. Such panes must be kept more or less open according to the need of ventilation. In this later case it is advisable to cover the whole opening outwardly with cheese cloth or canvas to moderate the draught of the air coming in through these openings.

The draught passing above the heads of the birds cannot harm them. Whatever be the shape or the plan adopted, care must be taken that the temperature of the poultry house be not too high during the coldest period of winter. The great fault of breeders is to heat the poultry house too much, with the thought of increasing the productiveness of their fowls. At the Central Experimental Farm, the pullets (of general utility type) kept last winter in a cold house (fig. 50) gave the best results as to fertilization of eggs and vitality of germs in hatching.

The roosts in a poultry house should be removable; also nests for layers (fig. 43).

The roosts should be flat, and never higher than three feet from the ground.

The platforms under these, on which the excrement falls (*b* fig. 43, or *a* fig. 45) should be covered with a thin layer of fine or very dry sand, ashes or lime, which prevents the discharges from soiling the platforms and renders their removal easier, as it absorbs moisture.

Each nest must contain a small quantity of very fine cut straw or of oat chaff, and not of hay, to which chicken mites are very partial.

The poultry house should be kept regularly cleaned, the litter of straw renewed as soon as it is damp and cut up by the scratching of the layers.

The inside walls should be whitewashed twice a year, as well as the nests and the roosts. Besides, during the hot season of the year, the latter should be washed or sprayed with coal oil at least once a fortnight; in this way chicken mites will be kept away, or if present destroyed.

Details of Construction of Poultry Houses.

The figures Nos. 44 and 45 show plans of a farm poultry house with cold scratching shed and comfortable roosting rooms. No artificial heating is needed.

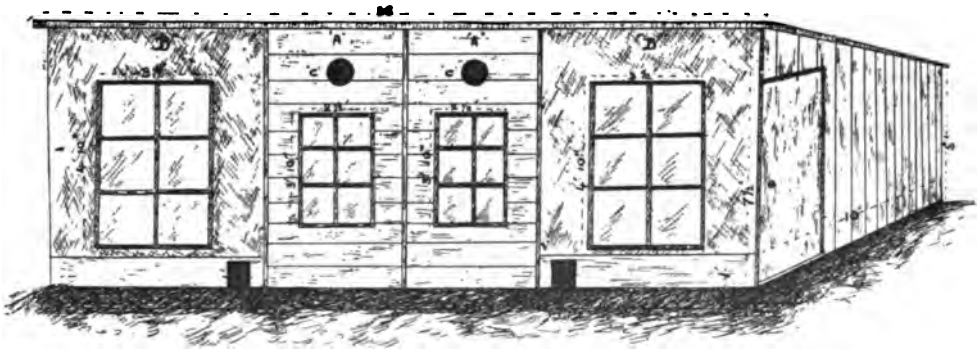


Fig. 44.

Accommodation.—This poultry house, or rather this double poultry house, should be 36 feet in length and 10 feet wide, outside measurement, and will accommodate thirty birds each, allowing for each hen six square feet of floor space, or twenty-six birds with seven square feet for each.

The beginner will find it more convenient and profitable to keep only twenty-six birds, or even only twenty-three, having thus each eight square feet. The hens need ample space in scratching for their food, and grain should be fed to the birds in this way while confined to the house.

The foundation must be made with sills, preferably of cedar, four inches square. For the frame, see building material, page 59.

Roosting Rooms—The roosting rooms (A A fig, 44 and 45) should be 8 feet by 10. The windows (see fig. 44) 2½ feet wide by 3 feet 10 inches in height, should be double in order to protect the birds from cold and placed at 20 inches from the floor, so as to let as much light as possible fall on the floor of the poultry house. Each roosting room must be provided with a self-regulating ventilator (as shown in the plan c c fig. 44) also an opening of 10 inches by 12 by which the hens can pass from the roosting room to the scratching shed (c c fig. 45). In winter, these openings must be kept closed at night.

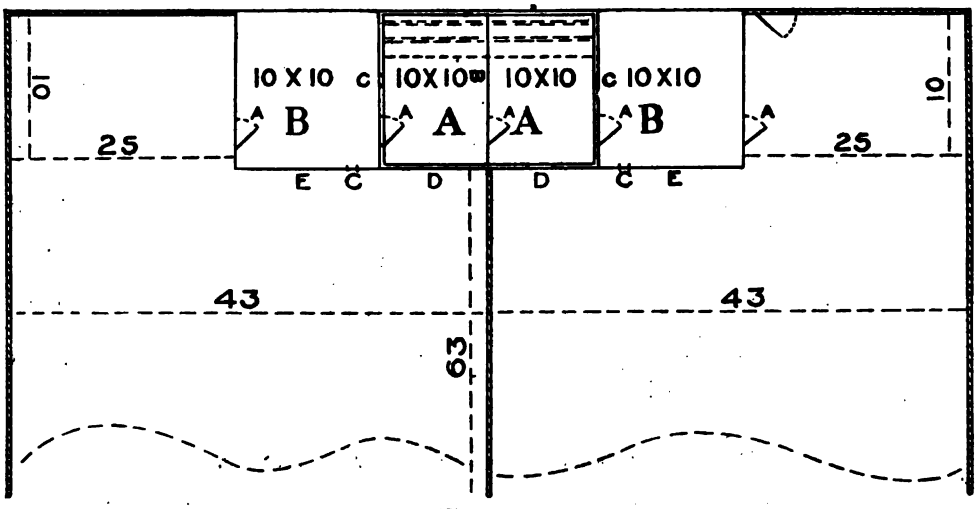


Fig. 45.

Walls—The four walls of the two roosting rooms should be of studding with two layers of building paper one on each side, then rough boards on either side of the studding, and the outside joints should be covered with battens of ½ inch by 2 inches.

The partition between each roosting pen may be made of netting or of cotton; but care must always be taken to nail about two feet of boards at the bottom, as well as at the door, in order to prevent the birds from breaking through the cotton and worrying each other.

Nests—In order not to lose any room on the floor, the nests (c c c c fig. 43) should be placed 20 inches above it, with an entrance near the wall for the layers. They should be provided with a door at the back toward the roosting room for the collection of the eggs. They should be about 14 inches square. The platform and roosts (a a and b fig 43) should be above the nests. The windows should be double to protect the birds in severely cold weather.

During times of great cold, in order to give additional protection to the birds during the night, it will be easy to hang up a cotton cloth or some canvas in a frame hinged so that it can be lifted up to the ceiling during the day.

Scratching Sheds—The scratching sheds should be 10 feet by 10, built with scantling 2x3 covered outside with a single layer of inch boards with battened joints to correspond with the other parts. The front, which faces the south. should be covered with

oiled cotton fixed to the studding, and in each division there should be a window 3½ feet wide by 4 feet 10 inches in height (see fig. 44) one foot above the floor. Below the windows it will be better to line with boards to give it the necessary strength.

Roof—The roof may be of shingles or specially prepared paper. If it is of paper, a thick layer of *tar* should be applied, and on it while still hot coarse sand or medium sized grit. A similar layer should be added every second year. The roof of the roosting rooms must, however, be made of double boards similar to the sides. The roof of the scratching sheds should be built with single boards.

Floor—Whatever material is used for the floor it must be at least six inches higher than the surface of the ground outside. It may be made of small staves covered with from four to five inches of sand, of cement or of tarred wood. No provision has been made for this in the list of material which follows:

List of building materials for the poultry house, 10 ft. by 36 ft. (Fig. 44.)

2 pieces 4 × 4 × 10 for end sills at $16 M	$ 2 00	
2 " 4 × 4 × 13 for front and hind sills at $16 M		
4 " 4 × 4 × 12 " "		
13 " 2 × 3 × 7′ 6 in. for front studs at $16 M	5 01	
13 " 2 × 3 × 5 for hind studs at $16 M		
2 " 2 × 3 × 7 for gable studs "		
2 " 2 × 3 × 6 " "		
14 " 2 × 3 × 12 for rafters "		
19 " 2 × 4 × 11 " "		
1,750 feet rough 1-in. boards at $15 M		26 25
60 pieces ½-in. × 2 × 12 battens at 4c. each		2 40
4 " 2 × 3 × 8 roosts		0 25
2 sashes for roosting chamber		1 80
2 double sashes for roosting chamber		1 80
2 sashes for scratching shed		3 60
5 squares, roofing paper		9 25
2 paper rolls		1 40
Sundries, nails, hardware, &c		4 25
Labour for 10 days at $2.50 per day		25 00
		$ 84 01

or $2.33 per running foot (floor not included).

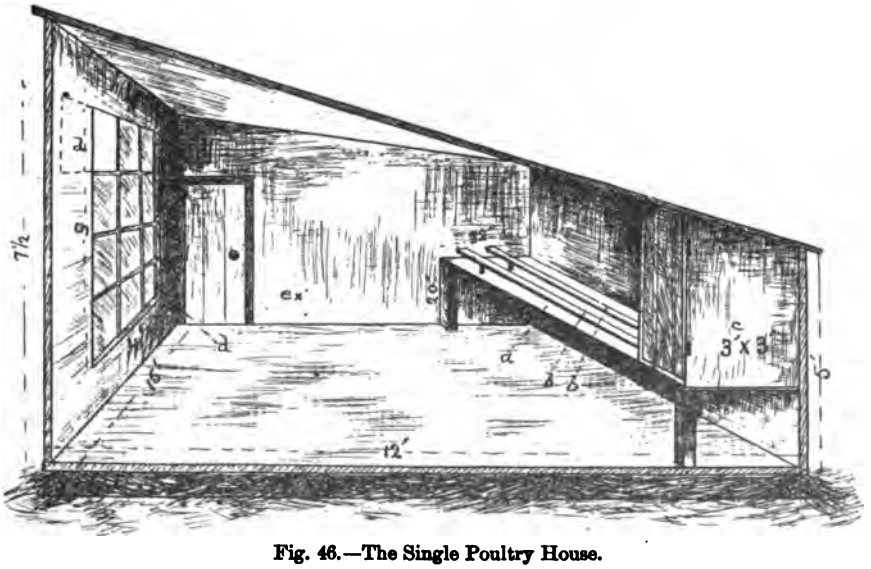


Fig. 46.—The Single Poultry House.

The Single Poultry House.—(Fig. 46) is 12 feet wide by 15 long, 7½ feet high in front and 5 at the back. This building has no separate scratching shed.

The size inside is 11 feet by 14, a space sufficient for 22 hens, allowing them seven square feet for each, or for 26 hens, with six square feet for each.

As in the plan (Fig. 44) this poultry house is built on scantling.

The roofs, walls and windows are double, built in the same way as the roosting rooms AA of the plan No. 45.

The platform supporting the roosts (Fig. 46) must be 11 feet in length by 2 ft. 8 in. in width and 20 in. above the floor; the roosts (BB Fig. 46) 6 in. higher, and 2½ in wide by 2 in. thick.

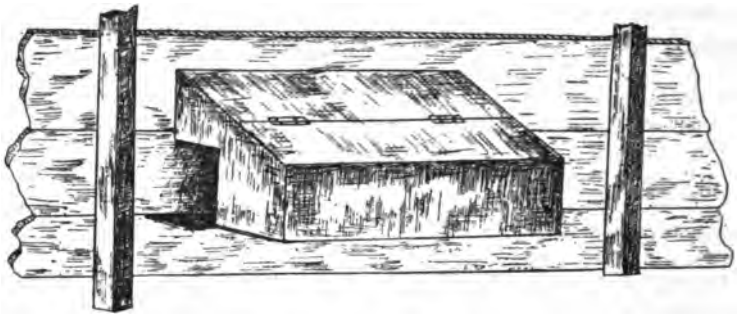


Fig. 47.

The nests (Fig. 47), five in number for heavy breeds, must be placed 20 in. above the floor and fastened to the wall (E Fig. 45) by means of a wooden clamp (Fig. 49.) Both nests and roosts must be movable.

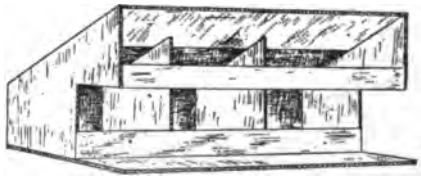


Fig. 48.

Fig. 49.

By the side of the roosts there should be a compartment three feet square (C Fig 46) for the male bird which must be removed from the layers as soon as the breeding season is over. The windows are 4 feet by 5. The ventilation is provided for by two openings in the window, one at the top the other at the bottom, by means of two sliding panes (DD Fig. 46). These openings must be covered outside with cotton cloth or canvas.

LIST OF BUILDING MATERIALS FOR POULTRY HOUSE 12 × 15 FT.—FIG. 46.

2 pieces 4 × 4 × 12 end sills at $16 M	$	1 15
2 " 4 × 4 × 15 front and hind sills at $16 M		
6 " 2 × 3 × 7½ studs at $16 M		
6 " 2 × 3 × 5 " "		
4 " 2 × 3 × 7 " "		
2 " 2 × 3 × 6 " "		5 30
2 " 2 × 3 × 15 " "		
2 " 2 × 3 × 15 " "		
2 " 2 × 3 × 12 " "		
7 " 2 × 4 × 17 rafters "		
1,250 feet rough boards at $15 M		18 75
45 pieces ½ × 2 inch battens, 4c		1 80
1 double window		1 90
2¼ squares roofing paper		4 16
Sundries, nails, &c		2 45
Labour, 6¾ days at $2.50 per day		16 75
Total	$	52 26

or $3.46 per running foot (floor not included).

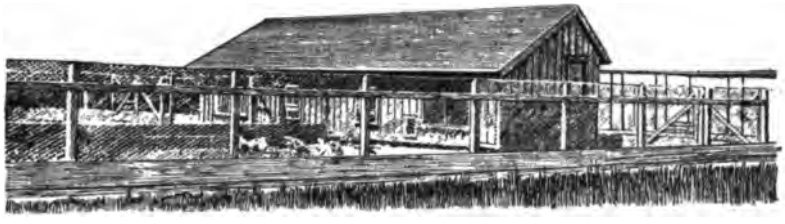


Fig. 50.

Fig. 50.—A double poultry house with its runs. Central Experimental Farm, Ottawa

The Poultry House (fig. 50) measures 12 feet in width by 40 in length; it is 5½ feet high in front and 7 at the back, with a passage 3 feet wide behind the two roosting rooms (*a* fig. 51). It will accommodate 32 hens on each side, allowing 6 square feet to each, or 28 hens with 7 square feet.

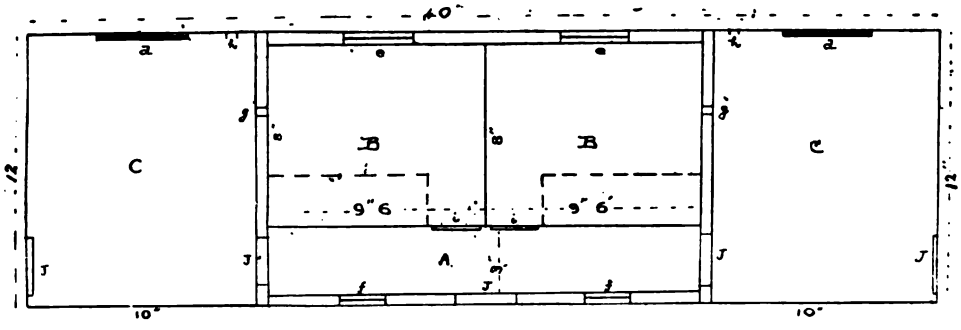


Fig. 51.—Ground Plan of Poultry House Fig. 50.

Roosting Rooms and Scratching Sheds.—The two roosting rooms (*bb* fig. 51) are 8 feet wide by 9½ feet long, inside measurement, and are divided in the same way as those of poultry house, fig. 44, page 57.

The scratching sheds (*cc* fig. 51) are 10 feet by 12 outside. The four walls of the two roosting rooms and those of the scratching sheds are built in the same manner as those of plan (fig. 44), excepting the front part, that towards the south, which is covered with one ply of rough boards with battens. There is a window in each scratching shed (*dd* fig. 51) of 3 feet 8 inches by 5½ feet, hung by means of hinges so as to open inward. Those of the roosting rooms (*ee* fig. 51) should be double and 2½ feet by 3 feet 10 inches. There must also be provided a frame covered with wire netting to fit into the window frame to prevent the birds from getting out when the window is opened.

Two other small windows (*ff* fig. 51) of 1½ feet by 2 should be placed in the passage way on the north side of the roosting rooms.

The doors (jj fig. 51) 2½ feet by 6½ at each end of the passage, are to reach each scratching shed and another of the same size in the middle of the poultry house on the north side for entering the building.

An opening (gg fig. 51) of 10 inches by 14 between each scratching shed and roosting room to allow the fowls to pass from one to the other. Another of the same size opening into the outside runs should be on the front of each scratching shed (hh fig. 51). These openings must be provided with sliding doors so that they may be closed if required.

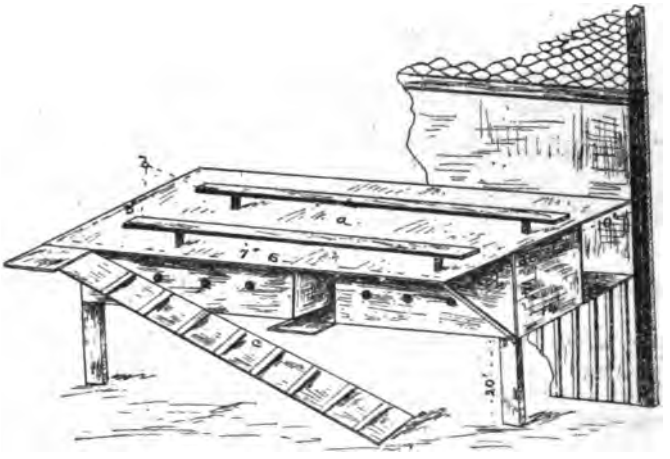


Fig. 52.

The roofing may be of shingles or of tarred paper prepared for that purpose, as described for plan (fig. 44). The ceiling above the passage and almost all of the roosting rooms must be 7 feet above the floor, so as to leave a little loft above the roosting rooms for straw for litter.

The nests (fig 52 and 53) are about 14 inches square and 20 inches above the floor. The platform (a fig. 52) 3 feet wide by 7 feet 6 inches long, the roosts (b fig. 52) of the same length and 22 inches by 2.

For heavy breeds, in order to enable the birds to reach the roost more easily, a board (c fig. 52) to serve as a step should be fastened by means of hinges either to the partition wall or to the platform.

The doors (bb fig. 53) are provided to render easy the cleaning from the passage of the platforms and (cc fig. 53) for the collection of the eggs. The trough (d fig. 53 is placed 6 inches above the floor.

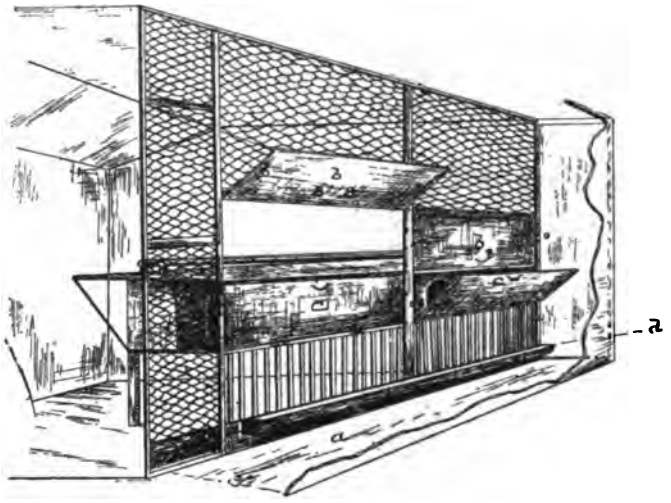


Fig. 53.

Accessories—Each pen must be provided with the following accessories: 1st, a drinking fountain placed from 4 to 5 inches above the floor; 2nd, a small box nailed to the wall about 5 inches above the floor to contain grit, lime, &c.; 3rd, a trough for the mash placed about the same height; 4th, if the floor is of cement or wood, a dust box filled with dry sand placed on the floor in such position as to receive the sunlight.

List of Building Materials for Poultry House 12 x 40 feet. (Fig. 50.)

2 pieces 4 × 4 × 12 end sills	$16 M	$2.30
6 " 4 × 4 × 14 front and hind sills	"	
14 " 2 × 3 × 7 hind studs	"	$3.25
14 " 2 × 3 × 5½ front "	"	
6 " 2 × 3 × 12 end "	"	
4 " 2 × 3 × 13	"	
2 " 2 × 3 × 14	"	
6 " 2 × 3 × 13	"	
2,000 feet rough boards at	$15 M	30.00
64 pieces ½ × 2 × 12 battens	4c. each	2.66
21 " 2 × 4 × 11 rafters	at $16 M	3.80
4 " 2 × 4 × 6 "	"	
12 " 2 × 3 × 12	"	1.15
6 squares paper	$1.85	11.10
2 rolls building paper		1.40
Sundries, hardware, &c		7.79
Labour at $2.50 per day, 12½ days		31.30
Total		$94.75

or $2.37 per current foot (floor not included).

The cost of the building of poultry houses, Figs. 44, 46 and 50, may be more or less according to the price of materials and labour; for many farmers may be able to build them themselves. In estimating for these buildings the lumber is all used rough.

MOVABLE SHELTERS.

Such shelters may be used not only to house chickens from two to two and a half months old till fattening time or till autumn, but they may also be used with advantage for birds intended for breeding, which it is wished to keep away from the winter poultry houses.

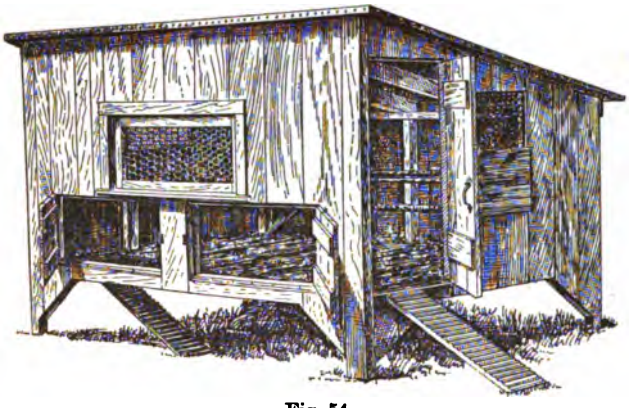


Fig. 54.

The shelter, fig. 54, is 10 feet long by 7 feet wide, 5½ high in front, above the floor, 2½ at the back; and the floor 16 to 18 inches higher than the ground, so as to shelter the birds under the building from rain, cold winds or a hot sun.

The doors, *a*, *a*, are 18 inches by 3 feet 8 inches; *b*, 2 feet 3 inches by 4 feet 2 inches. The opening, *c*, is to let the chickens in from under the shelter.

It may be built of scantling, 2 by 2 inches and with rough ½-inch boards. The roof and floor must be of 1-inch boards, and the rafters, 2 by 4 inches. The roof may be covered with tarred paper and finished in the same way as that of poultry house, fig. 44.

This shelter can house 75 birds during the night. The cost of materials for such a structure is about $6.

Fig. 55.

The shelter, fig. 55, is 6 feet long, 4½ wide, 4½ high in front, above the floor, 3 feet 4 inches at the back, built in the same way as the shelter, fig. 51; or it may be covered with cotton cloth instead of boards. The floor is 14 inches above the ground. This will house 24 chickens. The materials necessary for such a building will cost about $4.

The small shelter, fig. 56, may be built in the same way as fig. 54. This is 4 feet 2 inches long, 2 feet 10 inches wide, 4 feet 6 inches high in front, above the floor, and 3 feet 4 inches at the back. The floor is 12 inches above the ground. This shelter will house 15 chickens. Built of lumber, the cost of the materials will amount to about $2.50.

Fig. 56.

MOVABLE POULTRY HOUSES.

Poultry houses are sometimes built on rollers so that they can be moved from place to place on the farm. Where this can be done conveniently it is a great advantage to the fowls to be put into the fields after harvest, or into gardens or orchards, where they

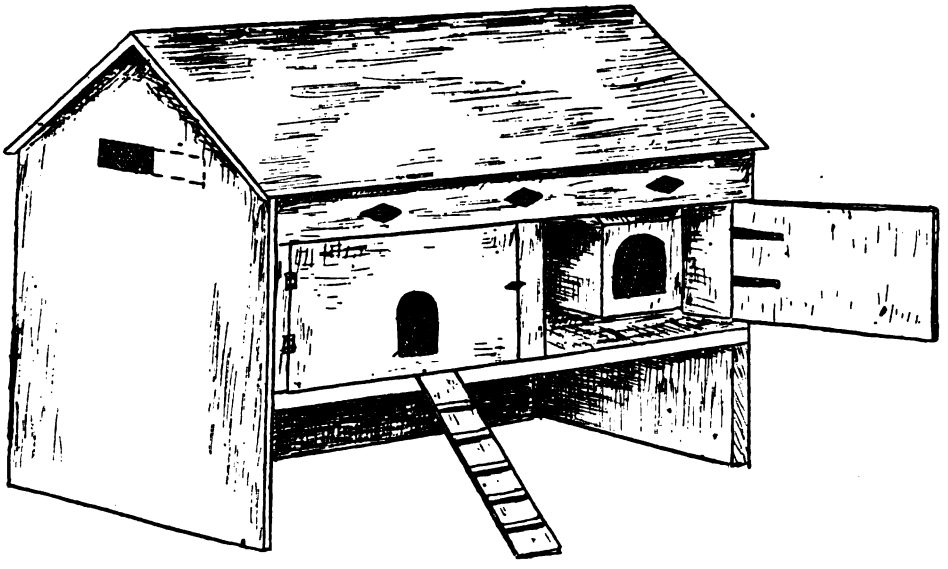


Fig. 57.

pick up fallen grain which might otherwise be wasted and consume considerable quantities of insects and weed seeds. The fowls thus benefit the farmer by destroying noxious insects and by picking up a large part of their own living, while a run over fresh ground and a larger area promotes the growth and vigour of the flock.

Such a poultry house will be useful to amateur poultry breeders who have not much space available; it can be conveniently placed in a yard, a garden or an orchard. A shelter arranged under it protects the fowls from the rain, the sun or the wind; inside are two roosts and a nest. To make cleaning easier, a door may be added at the back. It should be built with thin boards and covered with either boards or cotton.

The Poultry Runs.

The hen has a wandering disposition; she needs exercise. In order to thrive she must have a certain liberty, ground enough for her to run about while picking here and there such food as is suited to her taste.

As most farmers own extensive grounds and seldom more than one breed of fowls, poultry raising is for them easy; but such as have to breed birds in small runs and on limited ground, will be under greater disadvantage and will probably suffer from poor fertilization and lack of vitality of the germs in the eggs used for hatching. With less than a hundred square feet (ten feet by ten) of land for each fowl, the soil would soon be infected by the droppings, and every particle of green vegetation would be eaten or destroyed. In such case, the ground must be purified by being turned over every month with a spade especially during summer, as the droppings soon contaminate the soil. It is advisable when turning the soil to sow in it seed such as barley, oats, wheat, &c. The hens exercise themselves scratching and find the germinated seeds which they relish very much.

Such sanitary precautions are most important and necessary especially for stock that seldom go outside of the run.

To keep fowls in a healthy condition they should have access to green grass, which they will eagerly consume. When the run is large and the grass well grown, the fowls do not destroy it, and, their droppings scattered over a wide area are not injurious.

A bare spot must always be kept, exposed to the sun where sand will be spread, where they will go and dust themselves.

Shrubs or trees should be planted in the runs to provide sufficient shade for the fowls during hot days. The run should be kept clean from straws, feathers or any other rubbish which would interfere with the growth of the grass.

FENCES.

It is necessary that fowls kept in a small enclosure should be safely fenced, especialy where there are several runs on the same piece of ground.

Fences are often made with boards or laths, eight or ten feet high, the idea being that this height is necessary, and that this is a good form of enclosure.

It is, however, more costly than is necessary, and is sometimes unsightly, and not easy to keep in repair.

Where space is limited, more profit will be found in keeping a breed of quiet habits such as one of the general utility type. Tho breeds of a roving disposition (the type for egg-laying) will suit those better who have a fairly large ground. However, with a very simple and cheap fencing (fig. 58 and 59) any breed may be kept. It may be made with netting or laths and must be from 5 to 6 feet high. Where wire netting

is used the posts must be about a foot longer, so as to admit of the fastening of that par of the netting above the cross bar.

(1.) Each scantling should be 12 feet long and be held by posts (fig. 59) 6 or 8 feet apart, 4 inches square or round and 6 feet long, sunk 2 feet down into the ground.

(2.) At the bottom, in order to protect the birds within from the wind and especially to prevent the breeding males from fighting, the fence must be boarded up to not less than 20 inches from the ground (d fig. 58).

(3.) The upper bar (cc fig. 58 and 59) should be 10 or 12 inches lower than the top of the fence. In this way the birds will not fly over it, unless very much frightened, as every time one tries to fly over a fence it usually stops on the rail or upper bar. When it does this it is then unable to reach the top of the fence with its feet, and will shortly fall back within the inclosure. After a few useless attemps it will generally remain quiet.

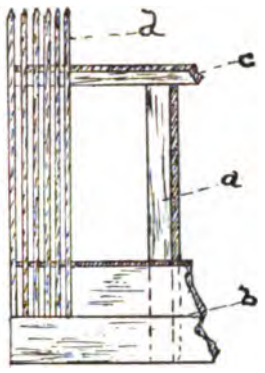


Fig. 58.

Fig. 59.

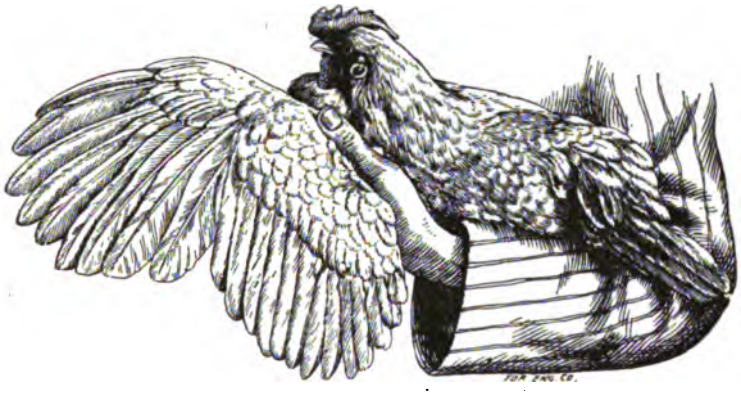


Fig. 60. How to hold the bird and the wing to cut the fly-feathers.

It is also very easy to keep the most restless breeds and varieties in small runs by means of fences such as those here described, by cutting the fly-feathers of only one

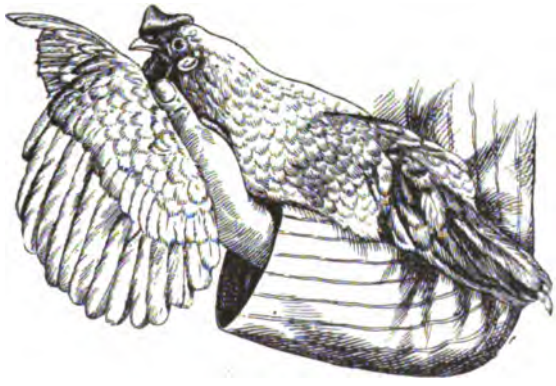


Fig. 61.

wing. Figure 60 shows how to hold the bird and the wing for this operation, figure 61 shows the wing when cut, and figure 62 the wing when cut and closed and pressed against the body of the bird. This can be done without any noticeable disfiguration of the wing.

Fig. 62.

Enclosure for a Poultry House.—To provide fowls with the means to take sufficient exercise in the open air during the summer months, and so that they may have green grass so desirable for their subsistence, they should when penned have a space of not less than 100 square feet, that is 10 feet by 10 for each fowl. Each run to accommodate comfortably the 30 hens that may be housed in the building shown on figure 44. should have an area of about 3,000 square feet, or say 43 feet wide by 63 feet long, including the small places shown on each side of the building on figure 45.

Should several such poultry houses be required, when the fowls cannot be given unlimited run, it will be better to build them about fifty feet apart. Such a space between each building is desirable to avoid epidemics which may occur, and also to provide a more suitable division of the runs. If the poultry houses followed each other in a straight line without any interspace, the runs would then be too long and narrow, and with such runs the hens do not always care to roam to the furthest end.

General Utility Types and Standards for Judging.

A general utility type must possess the following qualities: excellence in egg-laying, flesh-producing, must be a good sitter, and of a quiet disposition. The general characters are:—

Standard Weight.—Cock, 7 to 9 pounds; hens, 6 to 8 pounds.
Carriage.—Erect, gentle and graceful.

Head.—Medium size, rather round than long. *Beak* (1): Short, curved, strong, yellow or horn colour. *Comb* (2): Medium size, single or double. *Eyes:* Large and bright. *Wattles* (4): Medium size, equal, rounded, of a fine texture. *Ear-lobes* (5): Red, well developed and even.

Neck (6).—Length well proportioned, moderately arched; shorter and more compact in the female.

Breast (7).—Bulging, wide, deep. *Breast-bone* (17): Long and straight.

Back (8).—Broad, ordinary length, concave in profile toward the rump; less so in the female. *Shoulders and Saddle:* Broad.

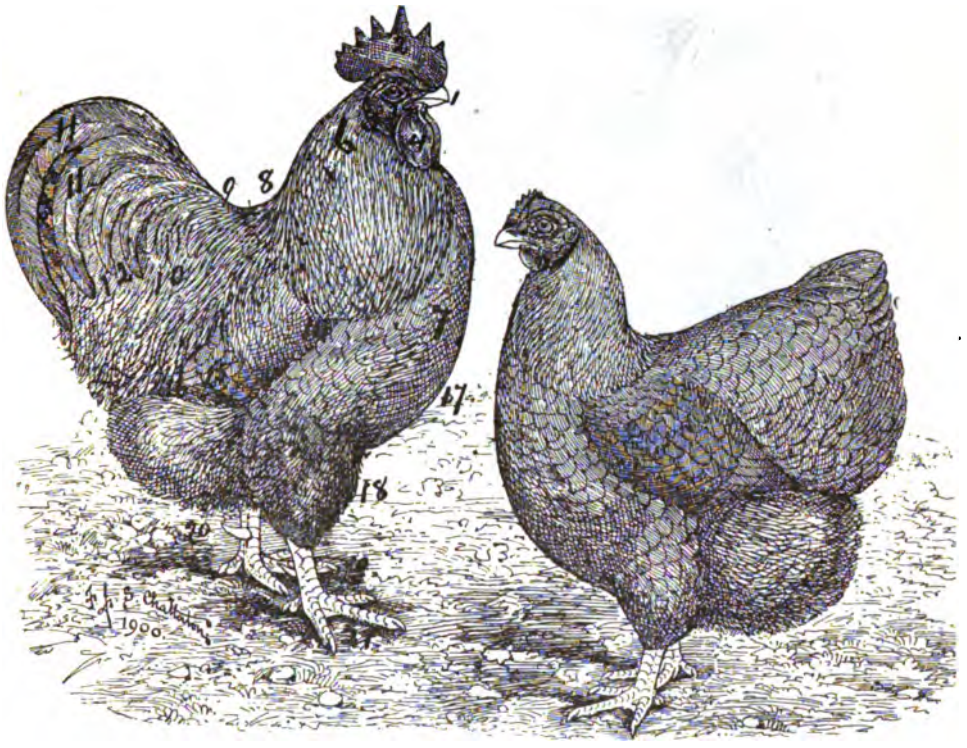


Fig. 63.

1 Beak. 2 Comb. 3 Face. 4 Wattles. 5 Ear lobes. 6 Neck. 7 Breast. 8 Back. 9 Saddle. 10 Saddle feathers. 11 Sickles. 12 Tail coverts. 13 Main tail feathers. 14 Wing-bow and wing-coverts, forming wing-bar. 15 Secondaries; wing-bay. 16 Primaries or flight-feathers. 17 Breast-bone. 18 Thighs. 19 Shanks or legs. 20 Spurs. 21 Toes.

Body.—Broad, compact, deep, rather long and round.

Wings (14, 15, 16).—Medium length, well folded and pressed against the body.

Tail (11, 12, 13).—Rather short than long, carried high and sickles graceful.

Legs (18).—Short, thick, well apart, and thickly clothed with downy feathers. *Shanks* (19): Rather short, without feathers, firm, of a fine yellow or pinkish white colour.

Toes (21)—Strong, four on each foot, straight and of same colour as the shanks.

Bony frame—Medium size.

Plumage—Close, fluffy and richly downy.

Skin—Fine, soft, yellow, white or pink colour, the last two being preferred.

The General Utility Types are: Plymouth Rocks, Orpingtons Wyandottes, Faverolles, Dorkings and other breeds or crosses close to these types.

Fowls of this type have a special aptitude for egg production, are but little broody, and the flesh of some is inferior in quality. They are of a restless nature. Their general features are:

TYPES FOR EGG-LAYING.

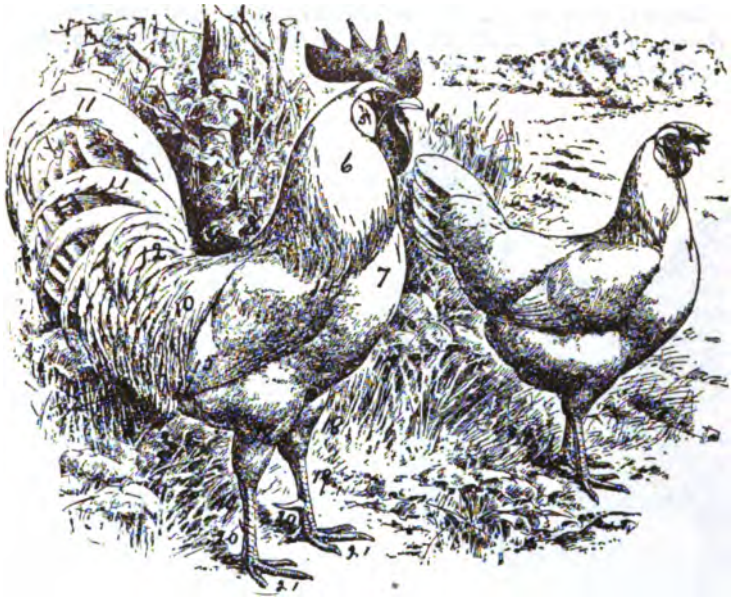


Fig. 64.

Standard Weight—Cock: 5½ to 7 pounds. Hen: 4 to 6 pounds.
Comb, Face and Wattles (2, 3, 4)—Bright red, an indication of a good constitution and good health. Look and carriage bold.
Head—Short, fine. *Beak* (1): Short, moderately curved, yellow, white or black. *Face* (3): Red and smooth. *Eyes:* Large, bright, red or bay-coloured. *Comb* (2): Single or double, of medium size, without folds or wrinkles, texture fine. *Wattles* (4): Moderately long, well rounded, thin, less thick in the female. *Ear-lobes* (5): Dull white, soft, smooth, round or almond-shaped and as well developed as possible.
Neck (6)—Long, well arched; plumage thick, covering the shoulders well.
Breast (7)—Round, deep, full.
Body—Long, cone-shaped, deep and plump in the female; pelvis broad; abdomen large and pendulous, abundantly clothed with downy feathers.
Plumage—Close, thick and bright-coloured.
Bony Frame—Rather small than large.
Back (8)—Medium length, with short concavity down to the tail.
Wings (14, 15, 16)—Ample and well folded.
Tail (11, 12, 13)—Well feathered and raised. *Larger Sickles* (11): Well arched. *Coverts* (12): Many and silky.
Legs (18)—Free, medium length and thickness, well apart.
Shanks (19)—Rather long, without feathers, white, yellow or black; the last two colours preferred.
Toes (21)—Of the same colour, straight, four in number on each foot.
Skin—Soft, tender, white or pink.

The best laying breeds are: White Leghorn, Black Minorca, Black Hamburgh; other varieties of Leghorn and other breeds or strains derived from these.

GENERAL TREATMENT OF POULTRY, INCLUDING DISEASES, INJURIES, &c.

Diseases often come from the poor constitution of the birds, but oftener yet from the unclean and damp state of the poultry houses and of the unsanitary condition of the soil, deficient ventilation of the buildings and the crowding of the birds.

Preventive Measures.

(1) *Site of the Poultry House.*—Poultry houses should have a southerly exposure so that the birds may have the full benefit of the sunlight, for disease is seldom seen where the sun shines. Poultry houses should also be placed where they are sheltered from north winds, which are always injurious.

(2) *Green Vegetation.*—Fowls when penned up during the summer should always have an abundant supply of green food.

(3) *Shade.*—Shrubs, and also trees, should be planted in poultry runs so as to give sufficient shade to the birds during the very hot days of summer. Fowls should go to the poultry house only to lay and to roost.

(4) *Cleanliness.*—At least twice a year roosts and walls should be whitewashed; this is the best means to destroy the parasites, which in spite of all cleanings are apt to infest the stock and building.

The soil in the runs should also be turned over from time to time to bury the excrement deposited on it.

Egg Bound.—This trouble is frequently the result of too much crowding, or of feeding grain exclusively, which causes an inflammation of the oviduct. The lack of lime in the food may also result in the breaking of the eggs in the oviduct; the preventive measures are of very easy application.

Symptoms.—The bird is distressed, has a capricious appetite, curves its back and remains standing or lying on its belly, which soon swells; diarrhœa sets in; finally after four or five days the bird dies; it is found on its back, the feathers of the abdomen and of the rump ruffled. Already before death, it may be seen that the skin of the belly and around the anus is red, swollen, distended and sore; sometimes even by inserting a finger in the anus the stopped egg or eggs may be felt.

Treatment.—In the first place give the bird a teaspoonful of castor oil, and, if there is no passage of the egg, give through the anus an injection of sweet oil, followed, if need be, by an application of belladonna ointment. The diet must be very cooling, composed of herbs, lettuce and dampened bran; the bird should be kept quiet in a small enclosure.

Freshly laid Eggs with stale taste.—This trouble occurs sometimes with excessively fat hens; when the egg cannot pass freely through the oviduct, which is almost obstructed with fat, it is retained in this organ sometimes for two or three days, and, if it is fertilized, the animal heat is sufficient to start decomposition. At that stage only the yolk is formed; then, when the yolk becomes surrounded with white and later with the shell, and is finally laid, though freshly laid, it has a stale taste.

As a preventive treatment, lessen the ration and remove the male bird from the layers.

Hernia of the Oviduct—Another affection, which has the same causes as that of egg bound; is a hernia of the oviduct due to catarrh; the abdomen becomes swollen and hard posteriorly. The skin of the belly is stretched, hot and shining. A mucous discharge which spreads and dries up around the rump, is an accompaniment of this disease; the irritation is strong enough to bring about the falling of the feathers.

Symptoms.—The hens drag their body on the ground; they eat and lay pretty well, but appear sickly among the others.

Treatment.—It is rather difficult to cure this affection; but the effects may be corrected by a cooling diet and by the application round the rump of a pomatum composed of 5 parts of sweet almond oil and 25 parts of glycerin; this mixture is brought to a lukewarm temperature, when 5 parts of powdered starch is to be added.

APOPLEXY.—A rather common disease in all classes of poultry when kept closely penned and liberally fed; due to a congestion of the brain.

Symptoms.—The eyes of the bird are dull, its head hangs down, the wings drag behind; a drivel runs from the beak, the comb becomes purple and black, the neck becomes stiff and when unrelieved the disease grows worse until the bird falls down and dies.

Treatment.—In the first place, the bird should be bled, either on the comb by means of a needle, or by cutting off a nail of each foot near its base, or, in the case of web-footed birds, by opening a vein in the webs of the feet; the treatment is completed by drenching the head from time te time with cold water until the disease abates.

For a few days, feed the bird with dampened bran and skim milk.

GAPES.—This disease is due to the presence in the bronchial tubes of very thin thread-like worms.

Symptoms.—As the disease increases, the bird becomes feeble, its appetite becomes less, there is coughing, ruffling of the feathers and increasing emaciation. Breathing is heavy and becomes more and more laborious, till death comes from choking after two or three days.

Treatment.—This consists in fumigating twice a day with tar, camphor or tobacco. The material chosen is placed on a vessel containing live coals; then the vapours that rise are concentrated in a tight fumigating apparatus (see fig. 65), each fumigation must last from twelve to fifteen minutes; they must be continued until all the symptoms disappear.

Fig. 65.

Some writers recommend mixing ground garlic in the mash; tonics are also recommended.

CHOLERA—Fowl cholera is one of the most contagious diseases; it is caused by the presence in the blood of a special infective microbe. The disease is very rapid in its progress and is nearly always fatal.

Symptoms.—The bird affected has its feathers ruffled, its wings low, is dejected, and appears to be very thirsty. The discharges are always foamy or glistening.

Treatment.—All treatments for this disease tried have so far failed. As soon as the disease breaks out in a poultry yard, the healthier birds should at once be removed

The poultry house must be disinfected, the walls, floor, roosts, and all the utensils used by the birds must be washed with milk of lime. The diet during the epidemic should be composed of vegetables to which bran is added.

DIPTHERIA.—This disease spreads rapidly, and if not checked kills in two to four days all the birds affected. There should be no hesitation to kill and bury or burn the diseased hens, if they are not of high value; for diptheria alone is enough to destroy the largest and most thriving flock.

Symptoms.—When the sick bird is examined, it is easily seen that the beak and the tongue are becoming coated with whitish, more or less thick, false membranes, that the nostrils are stopped up with a mucous secretion; breathing is laborious, the bird is drowsy, its feathers ruffled and its gait tottering.

Treatment.—Smear the beak and throat with a feather dipped in a mixture of vinegar, one part, and ordinary honey, two parts, brought to a gentle heat to facilitate their thorough mixing.

Another treatment is as follows: Remove the above-mentioned false membranes with a damp and lukewarm sponge, dry the sores with the same sponge and burn them with a small silver nitrate pencil; when new false membranes form, smear the beak and throat with a solution of Carle Seiler's tablets,* one tablet dissolved in two ounces of water. Repeat every other day, one day burning, the next smearing.

The diseased birds must be removed from the flock, the water and litter changed and the poultry house disinfected.

ANÆMIA—This disease attacks all poultry birds; it is due to bad sanitary conditions and bad feeding.

Symptoms.—Loss of appetite, general emaciation, excessive prostration, paleness of the comb and presence of pustules on the head or the throat wattles.

Treatment.—The treatment consists in keeping the poultry house quite clean, protecting the fowls from the weather, giving nourishing food and removing the weak ones from the flock.

CONSTIPATION—This is rather a frequent ailment in poultry, caused sometimes by a too liberal feeding of such food as oats, buckwheat, &c.

Sitting hens and good laying hens often suffer from it.

Symptoms.—The bird makes efforts to discharge its droppings, which are drier and harder than in normal conditions, forming round, chalky masses. This trouble is sometimes accompanied by depression and loss of appetite.

Treatment.—The treatment consists in giving laxative food, such as green vegetables mixed with bran. A spoonful of olive oil two or three days in succession has an excellent effect. It is advisable for geese to administer five or six grammes of sulphate of soda in a tablespoonful of water.

DIARRHŒA IN YOUNG CHICKENS—There are two kinds of diarrhœa—bilious diarrhœa, which often spreads rapidly, and chalky diarrhœa.

The causes of bilious diarrhœa are: Damp soil or a damp poultry house and unsuitable food.

Symptoms.—Green, almost liquid droppings.

Treatment.—Taken in time, diarrhœa is easily checked by a change in the diet, by giving heating grains—such as ground oats and buckwheat—a mash composed of hard-boiled eggs finely minced, cooked rice and cut and cooked vegetables. A little powdered

* Carle Seiler's tablets are made as follows: Take sodium bicarbonate, sodium borate and sodium chloride, of each, 60 grains; sodium benzoate, 4 grains; sodium salicylate, 4 grains; oil of eucalyptus, 2 drops; thymol, 2 grs.; menthol, 1 gr.; oil of wintergreen, 1 drop. Mix and make 12 tablets.

sulphate of iron (green vitriol) completes the treatment; about half of a small teaspoonful in a quart of water. Allow the affected birds to drink freely of this. The sick birds must, of course, be kept in a healthy and dry place, and should, if practicable, be kept apart from the other chicks.

CHALKY DIARRHŒA.—Is very common among chickens, especially where they are produced on a large scale, and where sanitary conditions are neglected.

Symptoms.—The chief characteristic of this disease is that the droppings have a chalk-like appearance, and by hardening they finally obstruct the passage and cause inflammation.

Treatment.—The remedy for this disease is rice water to which some sulphate of iron is added, about half a small teaspoonful to a quart of water. Feed also a mash such as is recommended for bilious diarrhœa, viz., hard-boiled eggs, cooked rice and vegetables.

Another remedy recommended is rice, 10 grammes; starch, 20 grammes; laudanum, 20 drops; water, 1 quart. The rice is boiled in water, the liquid is poured off on the starch already mixed with a little cold water, and the laudanum is added.

The obstruction of the anus in chickens may be released with a little brush soaked with lukewarm sweet oil.

BUMBLE-FOOT—This is a swelling caused by a sprain often brought about when alighting from roosts that are too high above the floor.

Treatment.—The remedy consists in making with a scalpel, provided matter is formed, a cross-shaped opening under the foot or between the toes, pressing the pus out, washing the wound frequently with warm water so as to keep it thoroughly clean. The sick bird must also be kept on a soft bed in a restricted space without roost until the cure is complete.

FRACTURE.—Fractures are detected by the difficulty of movement of the injured limb and pain.

They heal naturally if the bones are properly kept in place.

Treatment.—The parts are kept in their place by means of one or two pieces of goose quill split lengthwise or a few splinters of thin cardboard applied on the broken bone and tied securely with thread. The limb will usually be healed in a fortnight. The injured bird should be kept apart in a quiet place.

SCALY LEGS.—This is an unsightly condition of the legs and toes of fowls. It is caused by damp and filthy quarters.

Symptoms.—The legs and feet are covered with grayish spots, which widen, forming rounded scales; these become raised and bleeding ensues; the birds walk and stand with difficulty.

Treatment.—Rubbing with pure coal oil every two or three days.

WEAK BONES OF YOUNG CHICKENS.—This affects particularly chickens raised in captivity; those running at large rarely suffer from it.

Although receiving abundant and easily digested food, the bony frame of chicks raised in captivity does not always develop properly when the food is deficient in phosphates; they make too much flesh in proportion to the bone formed, and these, being too weak, bend under the weight of flesh which they bear.

The general weakness affects not only the feet and legs, it is often seen elsewhere, in humpbacks, curved breastbones, &c.

Such imperfections may be prevented by mixing with the mash for the chicks a small quantity of bones finely ground. Increase the quantity given gradually as the chickens grow.

INFLAMMATION OF THE INTESTINES.—This inflamation is usually associated with diarrhœa or dysentery and usually affects full grown birds.

Symptoms.—The bird is moping, scarcely eats, the feathers are ruffled, and the wings droop; the fœces emit an unpleasant odour.

Treatment.—Taken early, the disease is treated with laxative drinks, healthy and cooling food. Milk in which is dissolved a small quantity of Epsom salts (sulphate of magnesia) a teaspoonful to a pint of water, a little bicarbonate of soda (baking soda) mixed in the same proportion may be given twice or three times a day. The sick birds should be isolated.

EGG EATING.—The chief causes are the want of limy matter in the food, close confinement, lack of exercise, and nests too much exposed to light. This habit is also sometimes induced when eggs are laid without shell or with very thin shells and broken in the nests.

Treatment.—Give the layers plenty of exercise, fresh air and food proper for egg-making, see also that they have dark nests.

MOULT.—This critical period when the feathers are renewed is generally in July and August. Some hens lose their feathers very slowly, taking several weeks, others moult in four or five days. The latter are to be specially watched. This crisis is sometimes checked by certain conditions of cold and damp weather, in such instances the new feathers remain for a longer or shorter time within their cases, giving the birds a very odd and stunted appearance. Excellent results are obtained by the use of stimulating food, such as a few hemp seeds, meat scraps, crushed green bones or animal food mixed with bran. The birds must be kept in warm and dry quarters.

OPHTHALMIA.—Inflammation of the eyes; filthy and damp poultry houses are generally the causes of this disease. It is often complicated with diphtheria. It is then contagious.

Symptoms.—The bird carries its head low, ruffles its feathers and loses its appetite, the mucous membrane of the eye is red and swollen; the eyes water more or less.

Treatment.—A cure may be effected in the beginning by simply bathing the eyes of the affected bird with a solution of five parts of sulphate of copper (bluestone) in a hundred parts of water. The food must be warm mash, milk and vegetable in plenty.

IMPACTION OF THE CROP.—This trouble often occurs in hens too voraciou or when the diet is changed and the birds eat too freely of it.

Symptoms.—The food accumulates in the crop, forming a hard mass which distends its membranous walls.

Treatment.—A dessert-spoonful of olive oil often brings back a normal state of things. When the obstruction is more obstinate the bird is made to swallow a small quantity of moderately warm milk; then an effort is made by working the crop to bring up the mass of food. Half a teaspoonful of bicarbonate of soda is administered dissolved in about a tablespoonful of water which often succeeds in causing the food to be thrown up. If these remedies fail resource may be had to surgical treatment. In that case the food is extracted by means of an incision in the crop, the feathers on the upper right hand side of the crop must be first plucked off. An incision about an inch in length is then made through the skin and membrane of the crop, this makes it very easy to remove all the food, a suture is then made, preferably with silk thread, from inside outward, and the seam is smeared with a little lard. The wound heals in eight or ten days, during which mash should be fed in small quantities.

FEATHER-EATING.—When this takes place the hens pick and eat the feathers from other birds, especially the pin feathers that are filled with blood. It is due to overcrowding, to confinement, lack of exercise and want of animal and fresh vegetable food.

Treatment.—Nothing further is necessary than to give the hens space, employment, some form of lime, animal food and fresh vegetables. The habit is successfully and immediately controlled by a small wire fixed to the beak and the nostrils. These wires are sold by dealers in poultry supplies.

WOUNDS.—Wounds are usually not dangerous and heal up of themselves. The healing is hastened by suitable binding and washing the part once or twice a day with water.

BROODINESS.—The irresistible desire to sit that takes possession of some hens may almost be called a disease.

Treatment.—When it is wished to make hens get over their desire to sit, they should be shut up in a cool, dark, quiet place and left for two days without food; they are given only water, which will cool down the nervous fever by which they are affected. It is advisable to give then afterwards only a small quantity of grain every morning, increasing it until they take their usual amount of food. After five or six days, they are placed with the other hens, and about ten days later they resume their laying.

The following is another very simple means to break up broodiness in a hen. Tie the legs together, and leave the hens either in the poultry house or in a shed without feeding. This is an expeditious method which gives very little trouble. Several breeders practice it successfully.

FALL OF THE RECTUM.—Often mistaken for hernia of the oviduct. The commonest cause is a protracted constipation.

Symptoms.—The rectum protrudes as a soft and half globular tumour of a bluish red colour.

Treatment.—Give very cooling food; it is sometimes necessary to wash the protruding part with tepid water and to force it gently in its place. The sick bird must be kept closely confined to keep it quiet, as for instance in a box, in a dark and very dry place. After a few days if restored it can be replaced with the others.

TUBERCULOSIS.—This disease, which is regarded as incurable, sometimes affects the different classes of poultry: fowls, turkeys, ducks, &c.

Symptoms.—There are no special symptoms by which the presence of this disease can be ascertained. It is a slow disease which causes wasting; the birds often become lame or dropsical.

This disease is thought to be transmissible from man to poultry, and it is quite possible this may be correct, the infection being communicated by the spitting of consumptive people about the poultry buildings or yards.

SCURF.—A skin disease which causes the feathers to dry up and fall.

Treatment.—Wash the parts affected with soap and water to which a little perline is added, after cleansing it this way and as soon as the feathers are dry apply a little gray ointment on the skin of the cleansed parts.

WORMS.—The diseases due to the presence of parastic worms in the intestines are rather difficult to determine. The parasites may be communicated to healthy fowls from the droppings of diseased ones scattered on the ground.

Symptoms.—Fowls when affected become more or less rapidly emaciated, weak, and suffer from diarrhœa.

Treatment.—Vermifuge powders should be administered, worm seed, areca nut, kamala. Anyone of these powders may be mixed with wetted grain, to which they will then adhere. The dose should be according to the size of the bird, from 2 to 8 grains, repeated several days in succession. Salycilic acid should be added to the drinking water at the rate of 80 grains to a quart. In the diseases produced by intestinal parasites a thorough disinfection of the chicken runs, pens, &c., should be systematically carried out. Creolin is a cheap and very effective parasiticide and should be used in the strength of creoline 2 parts, water 100 parts, to be sprinkled over the premises at frequent intervals. The droppings from pens should be collected and destroyed.

LICE.—The presence of lice is frequently the result of the filthy state of the poultry house. When a fowl is infested it may be relieved in two ways: (1) By applying on the skin a little blue ointment, the size of a barley corn, divided into three or four parts under the rump, the wings and the fluff. As a rule two applications per year are sufficient, one in the autumn, another in the spring. (2) In the evening the fowl is taken from the roost and held by the legs, head downward, when a few pinches of insect powder are thrown under the wings, under the rump, on the back and on the head. When this is done the bird is quietly replaced upon its roost. Lice may be largely prevented by placing in the poultry houses or the yards boxes of dry sand or earth in which the fowls can dust themselves.

MITES—These parasites which are especially to be feared in warm or stormy weather, must be watched with greatest attention; for they are among the dangerous enemies of fowls. It is wise to take preventive measures against them. Besides the usual precautions of cleanliness, sprinkle the roosts, joints, openings and covers with coal oil about every fortnight in summer and twice during the winter. If a poultry house is infested, it is easily seen by the following indications :—(1) When the hand is passed under the roosts, large numbers of red mites are found there; (2) A blow with a hammer on the joints, openings or corners, especially near the roosts, will bring out large numbers of mites, which will be easily seen. In such cases :—(1) Clean the room and burn the litter. (2) Sprinkle coal oil on the places above mentioned. The following day thoroughly whitewash with strong milk of lime. To make the whitewash adhere, add about two to three handfuls of coarse salt to a pailful of the whitewash. Two days later, hammer again on the infested spots, when if any mites fall they will be easily seen creeping about on the whitewash; then the application of coal oil must be repeated.

VARIOLA.—This most contagious disease is also called chicken pox.

Symptoms.—The wings and tail of the bird are drooping, the skin is hot and red the back is rounded; the bird refuses all food and breathes with difficulty.

The first days of the appearance of the symptoms, pustules form on the neck, the head, &c., they dry up into crusts of a more or less bright colour.

Treatment.—As soon as the disease appears, the affected birds must be isolated and the building disinfected. An application should be made (and, as a rule, one is enough) with a feather dipped in the following mixture:

Kerosene (coal oil).....	1 liquid ounce.
Cedar oil,.....	1 "
Vaselin	2 ounces.
Powdered sulphate of copper.	1 "
Carbolic acid.....	10 drops.

The crust which forms after the application, need cause no anxiety; it will fall off of itself. The treatment is to be supplemented by a diet composed of cooked and strengthening food, with rice water to check diarrhœa.

133
.F22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

RESULTS OBTAINED IN 1906

FROM

TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS
AND
POTATOES

BY

WILLIAM SAUNDERS, C.M.G., LL.D
Director of Experimental Farms

AND

CHAS. E. SAUNDERS, Ph. D.
Cerealist.

BULLETIN No. 55

NOVEMBER, 1906.

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER,
MINISTER OF AGRICULTURE

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

RESULTS OBTAINED IN 1906

FROM

TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS

AND

POTATOES

BY

WILLIAM SAUNDERS, C.M.G., LL.D
Director of Experimental Farms

AND

CHAS. E. SAUNDERS, Ph. D.
Cerealist.

BULLETIN No. 55

NOVEMBER, 1906.

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER,
MINISTER OF AGRICULTURE

TABLE OF CONTENTS

	Page.
Results of Experiments with Spring Wheat	6
" " " Durum or Macaroni Wheat	8
" " " Emmer and Spelt	10
" " " Oats	12
" " " Six-rowed Barley	15
" " " Two-rowed Barley	17
" " " Pease	19
" " " Indian Corn	21
" " " Turnips	24
" " " Mangels	26
" " " Carrots	28
" " " Sugar Beets	30
" " " Potatoes	32
Summary	35

To the Honourable

The Minister of Agriculture.

SIR,—I beg to submit herewith, for your approval Bulletin No. 55 of the Experimental Farm series, which has been prepared by the Cerealist, Dr. C. E. Saunders and myself. There are presented in this publication the results of a large number of experiments, which have been conducted at all the experimental farms in your Department during the season of 1906, with spring wheat, durum or macaroni wheat, emmer and spelt, oats, barley, pease, Indian corn, turnips, mangels, carrots, sugar beets and potatoes, in plots of uniform size, and with the crops grown under fairly uniform conditions. The average results are also given of the tests for the past five years of those varieties which have been long under trial.

These test plots are conducted with the object of gaining information as to the relative productiveness of the different sorts and their earliness in ripening. The returns show much variation in the weight of the crops grown and point to the importance of care in the choice of varieties of seed for sowing. It is hoped that these results giving the experience gained under some of the more important climatic variations found in the country, will prove useful to farmers in every part of Canada.

I have the honour to be,

Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, November 16th 1906.

RESULTS OBTAINED

FROM TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS AND POTATOES

By William Saunders, C.M.G., LL.D., F.R.S.C., F.L.S., &c.

Director of Experimental Farms

and Chas. E. Saunders, B.A., Ph.D., *Cerealist.*

During the past twelve years experiments have been conducted on uniform trial plots at each of the Dominion Experimental Farms for the purpose of gaining information as to the most productive and earliest ripening varieties of grain, fodder corn, field roots and potatoes. In arranging for these plots the same varieties have been sown at each of the farms, the seed being supplied at the outset from a common stock. In each case the seed has been sown early, and, as a rule, all the different sorts of the same crop have been sown on the same day or at most within two or three days so as to give to all an even start. The land chosen each year for these plots has been as nearly uniform in character as could be found and before sowing has been brought into a good condition of tilth. In this bulletin which is the twelfth of the series, the results of the experiments are presented in the same form as that of last year, giving special prominence to the average yield of each variety for the past five years, as being the more trustworthy basis from which to draw conclusions, and relegating the figures obtained in the current year to a subordinate place.

The varieties are therefore placed in the tables in the order of their average yield for the last five years. Those which have only been grown for shorter periods are placed in a separate group. While a five-year period is undoubtedly rather short, it seems undesirable to lengthen it, since by so doing all recently introduced varieties would be kept too long from taking their place in the tables with the older sorts.

The averages of the returns from all the experimental farms, which in past issues of this bulletin have been published in special tables, are omitted this year. It has been thought unnecessary to continue the publication of them since they have been given for so many years and are of value rather from a statistical than a purely agricultural point of view.

At the Central Experimental Farm at Ottawa, nearly all sorts of cereals have yielded well during 1906, especially those which mature early. Owing to the uuusually dry weather in midsummer some of the later ripening sorts gave less than an average yield. The crops of pease have been below the average. Indian corn has given good

returns in the fields but it has fallen off considerably in the plots owing to unsuitability in the soil for a hot dry season. Turnips have given about half the usual yield, while other field roots have given almost average crops. Dry weather reduced the potato crop to less than half of an average yield and the tubers are small.

At Nappan, the spring season was unfavourable, and owing to the ground being cold and wet, seeding was much delayed. The very hot weather which prevailed later in the year was favourable for Indian corn, but hurried the ripening of the grain so that the crops have been below the average. The root crops also in consequence of protracted dry weather in the autumn have been much lighter than usual.

At Brandon the harvest returns have been very gratifying, and wheat, oats and barley have all given excellent crops. Pease have done unusually well, and the yields of Indian corn, field roots and potatoes have all been good.

At Indian Head the crops of wheat and barley have been very good, while oats have given phenomenal yields, the 37 varieties under trial in the test plots having averaged over 105 bushels per acre; potatoes have given a medium return, while pease, Indian corn and field roots have given crops below the average. Field roots at Indian Head suffered much from the attacks of cut-worms, the carrots were entirely destroyed by them, and the other field roots had their first and second sowings so injured that a third sowing was necessary, but this was too late in the season to permit of the maturing of an average crop.

At Agassiz the wheat suffered again from the depredations of the midge, *Diplosis tritici*, which very much reduced the crop. Oats and barley have given very fair returns, so also has Indian corn. Carrots gave a very heavy yield, bnt the crops of other field roots were light.

The following lists include only those varieties which are being grown on all the Dominion Experimental Farms.

In computing the averages for these tables the same five years have been used in each case, except in a few instances where the omission or failure of one of the plots made a blank in the records for that year. These instances are marked with a cross † and the true position in the tables of the varieties so marked is on this account to be regarded as somewhat uncertain.

Cross-bred varietics produced on the experimental farms are marked with an asterisk.

SPRING WHEAT.

Sixteen varieties of spring wheat (exclusive of the durum or macaroni wheats) have been grown on the uniform test plots at all the Dominion Experimental Farms during the past season. The size of the plots was one-fortieth of an acre at Ottawa, Ont., Nappan, N.S., and Agassiz, B.C.: while at Brandon, Man., and Indian Head, Sask, the plots were each one-twentieth of an acre. The seed was sown at the rate of one and one-half bushels per acre. The dates of sowing were as follows: At Ottawa, May 1st and 2nd; at Nappan, May 17th and 18th; Brandon, April 23rd and 24th, and at Indian Head, April 11th.

The yield is expressed in bushels per acre, the bushel of wheat being 60 pounds.

SPRING WHEAT.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston *	33	20	104	38	..	12	White Fife	27	20	111	25	40
2	Bishop *	31	52	102	41	40	13	Stanley *	26	16	106	29	..
3	Pringle's Champlain	31	48	106	33	40	14	Haynes' Blue Stem—(Minn. 169)	25	8	112	25	..
4	Herisson Bearded	30	32	108	32	40		(For less than 5 years).					
5	Huron *	30	10	109	36	20							
6	Colorado	29	52	105	40	..		Hungarian White (2 years)	35	20	102	37	40
7	Laurel *	29	36	109	32	20		Riga * (1 year)	..	..	.....	32	20
8	White Russian	29	32	112	29	40							
9	Red Fern	29	..	108	24	40							
10	Red Fife	28	28	111	29	40							
11	Percy *	28	..	105	33	40							

The average crop of the sixteen varieties of spring wheat tested on the Central Experimental Farm at Ottawa in 1906 was 32 bushels 38 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Red Fife	34	16	112	33	20	11	Haynes' Blue Stem	27	40	115	27	..
2	White Fife	33	48	114	32	..	12	Percy *	27	12	113	27	40
3	Preston *	32	40	111	28	..	13	Herisson Bearded	27	4	112	23	..
4	Colorado	32	..	110	30	40		(For less than 5 years).					
5	Laurel *	31	40	115	26	40							
6	White Russian	31	12	105	31	20		Bishop * (2 years)	32	20	104	32	40
7	Pringle's Champlain	30	52	110	27	20		Hungarian White (2 years)	28	40	103	28	20
8	Stanley *	30	4	113	30	..		Riga * (1 year.)	..	.	.....	27	..
9	Red Fern	29	36	112	34	..							
10	Huron *	29	16	111	27	20							

The average crop of the sixteen varieties of spring wheat tested on the Experimental Farm at Nappan, in 1906 was 29 bushels 27 lbs. per acre.

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston *	35	32	122	44	..	11	Haynes' Blue Stem	31	24	129	36	..
2	Red Fife	35	28	125	40	..	12	Red Fern	29	18	121	32	..
3	White Fife	35	22	125	35	10	13	Colorado	28	32	121	34	20
4	Huron *	35	6	121	43	50		(For less than 5 years).					
5	Pringle's Champlain	32	48	120	41	50							
6	Percy *	32	36	120	34	50		Bishop * (2 years)	38	35	119	35	10
7	Stanley *	32	30	121	35	10		Hungarian White (2 years)	36	45	125	35	10
8	White Russian	32	12	124	31	20		Riga *	..	..	.....	34	50
9	Herisson Bearded	32	2	121	34	30							
10	Laurel *	31	28	124	25	40							

The average crop of the sixteen varieties of spring wheat tested on the Experimental Farm at Brandon in 1906 was 35 bushels 52 lbs. per acre.

SPRING WHEAT—*Continued.*

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston *	43	2	130	46	..	11	Pringle's Champlain	36	29	132	39	..
2	Stanley *	41	59	130	45	20	12	Haynes' Blue Stem	35	31	134	39	20
3	White Russian	41	40	128	41	..	13	Herisson Bearded	35	27	135	42	20
4	Percy *	40	55	130	41	20							
5	White Fife	40	17	136	48	40		(For less than 5 years).					
6	Huron *	40	13	128	42	20							
7	Red Fife	38	27	136	43	40		Bishop * (2 years)	43	30	130	44	..
8	Laurel *	38	10	137	43	40		Hungarian White (2 years)	29	..	131	41	20
9	Red Fern	38	7	132	42	..		Riga * (1 year)	..	..	.....	35	20
10	Colorado	36	34	131	39	40							

The average crop of the sixteen varieties of spring wheat tested on the Experimental Farm at Indian Head in 1906 was 42 bushels 11 lbs. per acre.

The spring wheat plots also the plots of durum wheat and of emmer and spelt at the Experimental Farm at Agassiz have again been so much injured by the wheat midge, *Diplosis tritici*, as to make the tests for 1906 as to the relative productiveness of the varieties of no value. Under the circumstances it is thought best to give here the average yields on the plots for the five years ending 1905.

EXPERIMENTAL FARM, AGASSIZ, B. C.

Number.	Varieties Tested.	Average Yield.		Number.	Varieties Tested.	Average Yield.	
	(For five years ending 1905.)	Bu.	Lbs.		(For five years ending 1905.)	Bu.	Lbs.
1	Stanley*	35	14	8	Percy*	31	53
2	Colorado	34	14	9	Haynes' Blue Stem	31	12
3	Laurel*	33	46	10	Red Fern	30	27
4	White Russian	33	27	11	Huron*	30	26
5	Red Fife	33	9	12	Herisson Bearded	30	17
6	White Fife	32	47	13	Pringle's Champlain	28	52
7	Preston*	32	39				

DURUM OR MACARONI WHEAT.

The results of the tests of varieties of durum wheat are published in a separate table, as these wheats possess qualities rather different from those of the ordinary sorts of spring wheat. While it is possible to make good flour from some kinds of durum wheat, such flour is generally unpopular. Furthermore the peculiar character of the kernels necessitates the use of somewhat different methods in the milling of these kinds of wheat. They are naturally, therefore, looked upon with disfavour by millers.

Farmers who grow any of these varieties should exercise great care to prevent them from becoming mixed with the standard sorts used for flour making.

DURUM OR MACARONI WHEAT—*Continued.*

Four varieties of durum wheat have been grown on the uniform test plots during the past season. The plots were of the same size as those sown with ordinary spring wheat and the seed was used at the rate of about one and three quarter bushels per acre. The dates of sowing were as follows: At Ottawa, Ont., April 27th; Nappan, N.S., May 18th; Brandon, Man., April 24th, and at Indian Head, Sask., April 11th.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties Tested.	Average Yield.	Average days maturing.	Yield in 1906.	Varieties Tested.	Average Yield.	Average days maturing.	Yield in 1906.
	(For five years.)	Bu. Lbs.	Days.	Bu. Lbs.	(For less than 5 years.)	Bu. Lbs.	Days.	Bu. Lbs.
1	Roumanian.....	38 8	111	41 ..	Yellow Gharnovka(3yrs)	33 20	105	31 40
2	Goose.....	28 ..	109	39 ..	Mahmoudi (3 yrs).....	21 40	108	18 40

The average crop of the four varieties of durum wheat tested on the Central Experimental Farm at Ottawa in 1906 was 32 bushels 35 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N. S.

Number.	Varieties Tested.	Average Yield.	Average days maturing.	Yield. in 1906.	Varieties Tested.	Average Yield.	Average days maturing.	Yield in 1906.
	(For five years.)	Bu. Lbs.	Days.	Bu. Lbs.	(For less than 5 years.)	Bu. Lbs.	Days.	Bu. Lbs.
1	Roumanian.....	25 28	113	22 ..	Yellow Gharnovka(3yrs)	17 7	105	20 40
2	Goose...	24 40	112	22 40	Mahmoudi (3 yrs.).....	13 33	105	18 40

The average crop of the four varieties of durum wheat tested on the Experimental Farm at Nappan, in 1906, was 21 bushels per acre.

EXPERIMENTAL FARM BRANDON, MAN.

Number.	Varieties Tested.	Average Yield.	Average days maturing.	Yield in 1906.	Varieties Tested.	Average Yield.	Average days matur. ing.	Yield. in 1906.
	(For five years.)	Bu. Lbs	Days.	Bu. Lbs.	(For less than 5 years.)	Bu. Lbs.	Days.	Bu. Lbs.
1	Goose	49 56	127	56 20	Yellow Gharnovka(3yrs)	51 20	127	53 ..
2	Roumanian.....	48 8	126	54 20	Mahmoudi (3 yrs.).....	45 20	129	46 20

The average crop of the four varieties of durum wheat tested on the Experimental Farm at Brandon in 1906, was 53 bushels per acre.

DURUM OR MACARONI WHEAT—*Continued.*

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties Tested.	Average Yield.	Average days maturing.	Yield in 1906.	Varieties Tested.	Average Yield.	Average days maturing.	Yield in 1906.
	(For five years.)	Bu. Lbs.	Days.	Bu. Lbs.	(For less than 5 years.)	Bu. Lbs.	Days.	Bu. Lbs
1	Goose.....	47 27	134	51 40	Yellow Gharnovka(3yrs)	48 48	135	52 40
2	Roumanian.....	46 2	136	47 40	Mahmoudi (3 yrs.).....	47 57	135	49 ..

The average crop of the four varieties of durum wheat tested on the Experimental Farm at Indian Head in 1906, was 50 bushels 15 lbs. per acre.

EXPERIMENTAL FARM, AGASSIZ, B. C.

Number.	Varieties Tested.	Average Yield.	Average days maturing.	Varieties Tested.	Average Yield.	Average days maturing.
	(For 5 years ending 1905.)	Bu. Lbs.	Days.	(For 2 years ending 1905.)	Bu. Lbs.	Days.
1	Roumanian.....	33 36	120	Mahmoudi.....	19 20	117
2	Goose.....	32 50	115	Yellow Gharnovka	18 ..	117

EMMER AND SPELT.

Two varieties of emmer and two of spelt were sown in the uniform test plots this season. They are arranged in the tables in the order of their yield for three years.

The plots were of the same size as those of spring wheat. The dates of sowing were as follows :—At Ottawa, Ont., April 28th ; Nappan, N.S., May 18th ; Brandon, Man., April 24th, and at Indian Head, Sask., April 17th.

The yield is expressed in pounds per acre, the grain being, of course, weighed with the husk adhering.

CFNTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1906.	Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1906.
	(For three years).	Lbs.	Days.	Lbs.		(For three years).	Lbs.	Days.	Lbs.
1	Red Emmer.....	2,440	107	2,680	3	Red Spelt.....	1,987	111	2,100
2	Common Emmer.....	2,273	101	2,720	4	White Spelt	1,960	108	1,740

The average crop of the four varieties of emmer and spelt tested on the Central Experimental Farm at Ottawa in 1906, was 2,310 lbs. per acre.

EMMER AND SPELT—*Continued.*

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1906.	Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1906.
	(For three years.)	Lbs.	Days.	Lbs.		(For three years.)	Lbs.	Days.	Lbs.
1	White Spelt.....	2,000	111	2,520	3	Common Emmer.....	1,227	104	1,760
2	Red Spelt.....	1,907	111	1,880	4	Red Emmer.....	1,020	110	1,040

The average crop of the four varieties of emmer and spelt tested on the Experimental Farm at Nappan in 1906, was 1,800 lbs. per acre.

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1906.	Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1906.
	(For three years.)	Lbs.	Days.	Lbs.		(For three years.)	Lbs.	Days.	Lbs
1	Common Emmer.....	3,600	126	3,820	3	Red Emmer.....	2,760	132	3,000
2	Red Spelt.....	2,893	129	3,180	4	White Spelt.....	2,087	130	2,740

The average crop of the four varieties of emmer and spelt tested on the Experimental Farm at Brandon in 1906, was 3,185 lbs. per acre.

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1906.	Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1906.
	(For three years.)	Lbs.	Days.	Lbs.		(For three years.)	Lbs.	Days.	Lbs.
1	Common Emmer.....	3,087	128	3,220	3	White Spelt.....	2,540	131	3,160
2	Red Spelt.....	2,913	130	3,600	4	Red Emmer.....	2,513	131	2,980

The average crop of the four varieties of emmer and spelt tested on the Experimental Farm at Indian Head in 1906, was 3,240 lbs. per acre.

EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested.	Average yield.	Average days maturing.	Number.	Varieties tested.	Average yield.	Average days maturing.
	(For two years ending 1905.)	Lbs.	Days.		(For two years ending 1905.)	Lbs.	Days.
1	Common Emmer.....	1,880	117	3	Red Emmer.....	1,660	117
2	White Spelt.....	1,775	117	4	Red Spelt.....	1,595	117

OATS.

During the season of 1906, thirty-seven varieties of oats have been under trial. The size of the plots on which they were grown was the same as in the case of spring wheat. The seed was generally sown at the rate of two bushels per acre, and the dates of sowing were as follows:—At Ottawa, Ont., May 4th; Nappan, N.S., May 18th; Brandon, Man., May 9th and 10th; Indian Head, Sask., April 23rd, and at Agassiz, B.C., on April 12th.

The yield is expressed in bushels per acre, the bushel of oats being 34 pounds.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years.)	Bus.	lbs.	Days.	Bus.	lbs.		(For five years.)	Bus.	lbs.	Days.	Bus.	lbs.
1	Twentieth Century...	75	26	104	68	8	21	Kendal Black*.....	64	8	107	58	28
2	Banner	74	28	105	68	8	22	Bavarian†.	64	6	107	64	4
3	White Giant.....	74	8	105	64	4	23	Golden Giant.....	63	30	110	52	12
4	Lincoln	73	22	105	68	8	24	Black Beauty.....	62	32	105	60	20
5	Mennonite	72	8	104	66	16	25	Buckbee's Illinois....	62	24	105	57	2
6	Golden Beauty	72	4	103	68	28	26	Kendal White*.....	62	12	105	60	20
7	Virginia White	71	14	104	50	..	27	Pioneer.....	62	4	104	57	2
8	Wide Awake.....	71	2	104	64	4	28	Goldfinder.....	61	30	106	58	8
9	Holstein Prolific.....	70	..	106	72	12	29	Improved Ligowo....	61	30	104	63	18
10	Columbus †.....	69	4	105	64	24	30	Siberian.....	61	22	106	61	6
11	American Triumph...	67	30	106	54	24	31	Joanette	60	8	108	70	20
12	Improved American..	67	30	106	55	30	32	Milford Black*	58	16	106	48	28
13	Irish Victor	67	22	106	70	20	33	Olive Black*.....	58	16	106	54	4
14	Sensation.....	67	6	105	54	24	34	Tartar King.....	58	16	102	62	32
15	Abundance	66	24	104	51	6	35	Waverley	56	4	106	54	4
16	Thousand Dollar. ...	66	8	104	74	4							
17	Danish Island..... .	66	.	105	61	26		(For less than 5 years.)					
18	Milford White*.....	65	30	105	56	16							
19	American Beauty....	65	18	102	67	22		Golden Fleece† (4 yrs)	64	3	104	60	20
20	Swedish Select†.....	64	16	106	58	8		Storm King (3 yrs.)..	36	16	99	27	2

The average crop of the thirty-seven varieties of oats tested on the Central Experimental Farm at Ottawa in 1906, was 60 bushels, 11 lbs. per acre.

OATS--*Continued.*

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bus.	lbs.	Days.	Bus.	lbs.		(For five years.)	Bus.	lbs.	Days.	Bus.	lbs.
1	Siberian	81	8	109	55	20	21	American Beauty	68	16	109	50	20
2	Improved Ligowo	77	14	106	50	20	22	Abundance	67	22	106	38	8
3	Goldfinder	76	32	111	63	18	23	Columbus	66	16	109	43	18
4	Lincoln	76	8	108	52	12	24	Wide Awake	66	12	107	40	..
5	Thousand Dollar	75	26	106	48	28	25	Tartar King	65	6	105	56	16
6	Twentieth Century	75	20	105	43	18	26	Buckbee's Illinois	63	10	109	41	6
7	Sensation	74	24	106	37	22	27	Irish Victor	60	8	106	40	..
8	Banner	74	..	105	44	24	28	American Triumph	60	6	113	45	30
9	Pioneer	73	22	104	50	20							
10	Joanette	73	10	105	45	10		(For less than 5 years.)					
11	Bavarian	73	2	107	50	..							
12	White Giant	72	28	108	42	12		Swedish Select, 4 yrs.	70	30	103	49	14
13	Mennonite	72	12	108	40	20		Golden Fleece, 4 yrs.	67	27	105	55	10
14	Holstein Prolific	71	10	107	49	14		Olive Black*, 4 yrs.	62	27	105	44	24
15	Danish Island	71	2	109	44	24		Kendal White*, 4 yrs.	60	27	105	48	8
16	Golden Giant	70	24	113	51	26		Kendal Black*, 4 yrs.	59	24	105	55	10
17	Golden Beauty	69	10	107	57	2		Milford Black*, 4 yrs.	59	8	104	54	26
18	Improved American	69	10	108	46	16		Milford White*, 4 yrs.	53	33	104	49	14
19	Waverley	68	28	107	38	28		Storm King, 3 yrs.	50	13	100	42	32
20	Black Beauty	68	28	103	40	20		Virginia White, 1 yr.	..	..	.....	48	8

The average crop of the thirty-seven varieties of oats tested on the Experimental Farm at Nappan in 1906, was 47 bushels, 18 lbs. per acre.

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Improved American	107	22	108	110	20	21	Mennonite	97	18	105	110	20
2	Buckbee's Illinois	107	..	110	99	24	22	Irish Victor	97	8	110	91	26
3	Golden Giant	106	9	114	99	14	23	Tartar King	94	16	106	110	..
4	Abundance	105	30	109	96	6	24	Black Beauty	93	22	107	92	22
5	Siberian	105	14	110	99	24	25	Joanette	91	24	110	85	20
6	Banner	104	6	110	114	4	26	Pioneer	89	14	108	87	22
7	Wide Awake	103	30	110	97	22	27	Sensation	88	18	108	103	8
8	Danish Island	103	14	110	105	10	28	Improved Ligowo	83	20	108	105	10
9	Goldfinder	103	5	113	97	2							
10	Twentieth Century	102	19	111	102	32		(For less than 5 years).					
11	Golden Beauty	101	26	110	96	16							
12	Lincoln	101	24	109	97	32		Golden Fleece (4 yrs.)	107	21	109	98	28
13	American Triumph	101	22	111	100	..		Kendal White* (4 yrs.)	102	2	111	100	20
14	Waverley	101	1	109	94	4		Olive Black* (4 yrs.)	95	15	114	92	12
15	American Beauty	100	32	108	116	16		Kendal Black* (4 yrs.)	90	20	114	82	12
16	White Giant	100	18	108	110	..		Milford Black* (4 yrs.)	88	8	113	79	24
17	Holstein Prolific	100	..	108	96	6		Milford White* (4 yrs.)	86	3	113	70	30
18	Columbus	99	26	109	107	2		Swedish Select (4 yrs.)	81	16	108	72	32
19	Thousand Dollar	99	18	109	105	20		Storm King (3 yrs.)	95	10	110	99	14
20	Bavarian	99	2	109	104	14		Virginia White (1 yr.)	..	..	.....	87	32

The average crop of the 37 varieties of oats tested on the Experimental Farm at Brandon in 1906 was 97 bushels 31 lbs. per acre.

OATS—*Continued.*

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Banner	114	19	116	128	28	21	Thousand Dollar	94	3	113	112	12
2	Goldfinder	105	10	119	119	14	22	American Beauty	94	1	116	98	28
3	Golden Beauty	104	1	116	114	4	23	Tartar King	93	11	115	103	18
4	Twentieth Century	103	18	117	103	18	24	Pioneer	92	18	116	100	..
5	Golden Giant	103	16	121	112	12	25	Siberian	91	17	120	97	2
6	Irish Victor	102	12	117	112	12	26	Sensation	91	13	115	109	14
7	Danish Island	102	6	114	102	32	27	Buckbee's Illinois	91	1	113	87	2
8	Columbus	101	29	118	111	26	28	Black Beauty	86	28	116	94	24
9	Bavarian	101	28	116	124	4							
10	Holstein Prolific	100	9	115	111	6		(For less than 5 years).					
11	Improved American	100	7	116	111	26							
12	White Giant	99	5	113	117	2		Kendal White* (4 yrs.)	110	15	120	107	2
13	American Triumph	99	2	117	108	8		Golden Fleece (4 yrs.)	105	1	122	115	30
14	Waverley	97	29	117	102	12		Milford White* (4 yrs.)	104	19	120	105	30
15	Improved Ligowo	97	27	115	122	32		Kendal Black* (4 yrs.)	101	16	122	115	10
16	Abundance	97	6	114	92	32		Olive Black * (4 yrs.)	99	13	120	93	18
17	Wide Awake	96	27	114	94	24		Swedish Select (4 yrs.)	99	11	116	95	10
18	Mennonite	95	20	114	114	24		Milford Black* (4 yrs.)	97	4	122	87	22
19	Lincoln	95	16	116	102	32		Storm King (3 yrs.)	94	18	117	90	20
20	Joanette	94	8	120	107	22		Virginia White (1 yr.)	..	..	.....	87	22

The average crop of the 37 varieties of oats tested on the Experimental Farm at Indian Head in 1906 was 105 bushels 29 lbs. per acre.

EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Abundance	69	12	115	58	18	21	American Beauty	59	28	116	70	20
2	Tartar King	68	29	112	54	24	22	American Triumph	59	16	114	52	32
3	Siberian	68	18	115	61	26	23	Thousand Dollar	59	16	116	60	20
4	Waverley	67	30	116	60	..	24	Buckbee's Illinois	58	32	115	64	24
5	Bavarian	66	30	116	68	8	25	Mennonite	57	13	113	45	30
6	Black Beauty	66	6	112	71	16	26	Wide Awake	55	8	116	51	26
7	Goldfinder	65	22	116	71	26	27	Twentieth Century	53	32	114	48	28
8	Danish Island	65	14	117	58	28	28	Golden Beauty	53	21	115	43	18
9	Lincoln	64	32	115	72	12		(For less than 5 years).					
10	White Giant	64	8	116	65	30							
11	Improved Ligowo	63	24	115	62	12		Golden Fleece (4 yrs.)	74	9	115	65	30
12	Improved American	63	8	115	62	12		Milford White* (4 yrs.)	68	10	114	62	22
13	Banner	62	26	115	58	28		Kendal White* (4 yrs.)	67	12	117	56	16
14	Columbus	62	8	116	50	30		Olive Black* (4 yrs.)	64	1	114	72	32
15	Irish Victor	62	7	115	59	14		Kendal Black* (4 yrs.)	59	16	115	57	22
16	Pioneer	62	4	112	61	16		Swedish Select (4 yrs.)	59	5	113	63	18
17	Sensation	62	4	114	50	20		Milford Black* (4 yrs.)	56	8	113	59	24
18	Holstein Prolific	62	1	114	60	6		Storm King (3 yrs.)	56	16	111	47	2
19	Joanette	61	20	114	57	22		Virginia White (1 yr.)	.....		.....	71	26
20	Golden Giant	60	14	118	63	18							

The average crop of the 37 varieties of oats tested on the Experimental Farm at Agassiz in 1906 was 60 bushels 7 lbs. per acre.

SIX-ROWED BARLEY.

During the season of 1906, eighteen varieties of six-rowed barley have been under test. The plots were of the same size as those of spring wheat. The seed was used in the proportion of two bushels to the acre; and the dates of sowing were as follows: At Ottawa, Ont., April 28th; Nappan, N.S., May 19th; Brandon, Man., May 28th; Indian Head, Sask., May 1st and at Agassiz, B.C., April 16th.

The yield is expressed in bushels per acre, the bushel of barley being 48 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties Tested.	Average Yield.		Average days maturing.	Yield in 1906.		Number.	Varieties Tested.	Average Yield.		Average days maturing.	Yield in 1906.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Nugent*	58	4	96	65	..	10	Common	51	32	93	53	36
2	Mensury	56	36	94	67	4	11	Brome*	51	8	97	42	24
3	Trooper*	56	32	92	69	8	12	Argyle*	49	28	96	62	4
4	Blue Long Head	55	44	96	61	32	13	Oderbruch	48	28	96	42	24
5	Albert*	55	36	96	77	4	14	Empire*	47	28	96	62	24
6	Stella*	55	28	95	47	4	15	Claude*	46	4	97	51	12
7	Yale*	54	16	95	58	16	16	Royal*	43	40	96	41	32
8	Odessa†	53	44	94	Failed.		17	Mansfield*	40	36	98	57	44
9	Summit*	52	8	93	51	32	18	Champion	36	12	93	32	24

The average crop of the 18 varieties of six-rowed barley tested on the Central Experimental Farm in 1906, was 55 bushels 25 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N. S.

Number.	Varieties Tested.	Average Yield.		Average days maturing.	Yield in 1906.		Number.	Varieties Tested.	Average Yield.		Average days maturing.	Yield in 1906.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Common	52	..	93	42	24	12	Argyle*	43	36	94	38	36
2	Mensury	50	8	96	43	16	13	Nugent*	43	28	97	27	44
3	Royal*	48	40	95	38	16	14	Summit*	43	20	99	36	32
4	Empire*	48	32	96	35	40	15	Mansfield*	43	12	96	35	20
5	Oderbruch	48	20	93	42	44	16	Claude*	41	36	94	38	16
6	Stella*	48	16	99	34	8	17	Champion	39	24	92	25	40
7	Trooper*	47	20	94	33	16							
8	Albert*	47	..	94	39	8		(For less than 5 years.)					
9	Odessa	46	20	93	45	..							
10	Brome*	45	20	97	30	20		Blue Long head (2 yrs.)	40	..	94	40	..
11	Yale*	43	40	97	32	24							

The average crop of the 18 varieties of six-rowed barley tested on the Experimental Farm at Nappan in 1906, was 36 bushels 33 lbs. per acre.

SIX-ROWED BARLEY—*Continued.*

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties Tested.	Average Yield.		Average days maturing.	Yield in 1906.		Number.	Varieties Tested.	Average Yield.		Average days maturing.	Yield in 1906.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mensury	60	36	91	61	12	12	Oderbruch	49	32	89	47	44
2	Yale*	60	34	90	60	10	13	Trooper*	49	6	93	55	10
3	Mansfield*	58	16	91	47	44	14	Common	48	28	88	49	8
4	Odessa	55	41	89	60	40	15	Stella*	48	16	92	48	46
5	Nugent*	55	44	92	65	40	16	Royal*	46	12	90	50	20
6	Argyle*	54	26	91	51	22	17	Champion	36	18	86	53	46
7	Summit*	54	24	93	50	10							
8	Albert*	54	14	88	55	40		(For less than 5 years.)					
9	Brome*	53	28	92	44	28							
10	Empire*	53	10	92	56	22		Blue Long Head (2 yrs.)	64	48	93	66	42
11	Claude*	53	8	92	57	24							

The average crop of the 18 varieties of six-rowed barley tested on the Experimental Farm at Brandon in 1906, was 54 bushels 34 lbs. per acre.

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Odessa	65	16	101	65	40	11	Royal*	57	40	100	50	40
2	Claude*	63	44	103	46	12	12	Trooper*	57	7	100	53	36
3	Nugent*	60	40	106	49	28	13	Brome*	55	46	104	44	28
4	Common	60	12	99	60	40	14	Oderbruch	55	37	99	55	..
5	Mansfield*	60	9	101	52	44	15	Argyle*	55	16	101	47	44
6	Stella*	59	39	104	47	44	16	Albert*	49	42	101	42	24
7	Summit*	59	4	103	48	36	17	Champion	40	11	97	41	32
8	Mensury	59	2	101	57	24							
9	Empire*	58	40	103	55	..		(For less than 5 years).					
10	Yale*	58	18	103	52	4		Blue Long Head (2 yrs)	68	46	102	64	8

The average crop of the 18 varieties of six-rowed barley tested on the Experimental Farm at Indian Head in 1906 was 52 bushels 3 lbs. per acre.

EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mensury	56	38	104	49	28	11	Mansfield*	48	2	106	32	24
2	Oderbruch	53	2	103	35	..	12	Summit*	47	36	108	33	16
3	Brome*	51	8	105	36	12	13	Common	47	28	103	36	32
4	Empire*	50	30	106	46	32	14	Champion	46	44	100	35	40
5	Stella*	50	8	109	37	24	15	Yale*	46	24	107	39	8
6	Claude*	50	1	103	42	24	16	Royal*	46	14	104	31	82
7	Albert*	49	44	104	34	8	17	Trooper*	45	4	109	39	8
8	Odessa	49	42	101	47	4							
9	Nugent*	49	26	107	39	18		(For less than 5 years).					
10	Argyle*	49	6	105	36	22		Blue Long Head (2 yrs)	46	27	102	43	16

The average crop of the 18 varieties of six-rowed barley tested on the Experimental Farm at Agassiz in 1906 was 38 bushels 35 lbs. per acre.

TWO-ROWED BARLEY.

Fourteen varieties of two-rowed barley were tested during the season of 1906, on all the Experimental Farms. The plots were of the same size as those of spring wheat. The seed was used at the rate of two bushels per acre; and the dates of sowing were as follows: At Ottawa, Ont., April 30th and May 1st; Nappan, N.S., May 19th; Brandon, Man., May 28th; Indian Head, Sask., May 1st and at Agassiz, B.C., April 16th.

The yield is expressed in bushels per acre, the bushel of barley being 48 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	French Chevalier	55	..	99	57	44	10	Harvey*	43	16	99	48	36
2	Canadian Thorpe	50	20	100	56	12	11	Sidney*	42	16	98	52	44
3	Danish Chevalier	50	..	99	52	44	12	Logan*	40	40	100	42	44
4	Standwell	49	36	100	67	44	13	Dunham*	40	8	101	53	36
5	Invincible	47	16	100	62	24							
6	Gordon*	47	..	98	56	32		(For less than 5 years.)					
7	Beaver*	46	16	96	57	24							
8	Jarvis*	46	4	97	57	4		Swedish Chevalier (3 years)	51	25	93	56	12
9	Clifford*	44	36	98	54	28							

The average crop of the 14 varieties of two-rowed barley tested on the Central Experimental Farm in 1906, was 55 bushels, 27 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Danish Chevalier	55	28	98	51	32	10	Standwell	37	12	99	33	36
2	French Chevalier	48	44	97	46	32	11	Sidney*	37	8	97	29	8
3	Beaver*	45	40	97	39	8	12	Gordon*	35	44	97	34	28
4	Logan*	40	32	98	35	..	13	Jarvis*	34	44	97	36	12
5	Invincible	40	2	98	38	16							
6	Clifford*	39	42	97	44	8		(For less than 5 years.)					
7	Dunham*	39	28	97	30	..							
8	Harvey*	38	40	97	32	24		Swedish Chevalier (2 years)	37	34	97	50	..
9	Canadian Thorpe	38	24	98	25	40							

The average crop of the 14 varieties of two-rowed barley tested on the Experimental Farm at Nappan in 1906 was 37 bushels, 31 lbs. per acre.

TWO-ROWED BARLEY—*Continued.*

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Gordon*	52	46	93	59	18	10	French Chevalier	43	24	95	61	2
2	Jarvis*	52	44	91	66	22	11	Canadian Thorpe	43	..	93	51	2
3	Harvey*	50	2	91	53	26	12	Danish Chevalier	42	24	95	51	42
4	Clifford*	48	44	92	60	30	13	Beaver*	41	14	94	48	26
5	Dunham*	48	24	92	49	38							
6	Standwell	46	28	95	47	14		(For less than 5 years)					
7	Invincible	45	42	93	50	10							
8	Logan*	45	12	93	47	34		Swedish Chevalier, (2 years)	54	38	94	55	40
9	Sidney*	43	40	90	49	38							

The average crop of the 14 varieties of two-rowed barley tested on the Experimental Farm at Brandon in 1906 was 53 bushels, 38 lbs. per acre.

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Invincible	65	42	109	52	24	10	Jarvis*	52	33	103	52	44
2	Standwell	63	30	108	52	24	11	Harvey*	50	7	102	46	32
3	Danish Chevalier	58	42	111	60	—	12	Logan*	49	15	103	46	12
4	Canadian Thorpe	55	42	106	48	16	13	Dunham*	44	15	102	39	8
5	Gordon*	55	19	102	52	24							
6	Sidney*	55	9	100	54	8		(For less than 5 years.)					
7	Beaver*	54	41	109	40	20							
8	Clifford*	53	4	102	52	24		Swedish Chevalier (2 years)	53	26	106	47	24
9	French Chevalier	52	46	111	41	12							

The average crop of the 14 varieties of two-rowed barley tested on the Experimental farm at Indian Head in 1906 was 49 bushels 2 lbs. per acre.

EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Canadian Thorpe	51	18	110	32	44	10	Clifford*	46	6	107	46	32
2	Dunham*	51	15	111	41	32	11	Gordon*	45	18	109	34	36
3	Sidney*	49	40	100	41	2	12	Jarvis*	42	46	110	34	8
4	Standwell	49	28	112	40	—	13	Logan*	41	21	110	27	4
5	Beaver*	49	22	111	37	24							
6	Invincible	49	22	110	36	32		(For less than 5 years)					
7	French Chevalier	48	44	112	41	42							
8	Harvey*	47	22	108	40	40		Swedish Chevalier (2 years)	47	19	106	42	14
9	Danish Chevalier	47	16	112	41	12							

The average crop of the 14 varieties of two-rowed barley tested on the Experimental Farm at Agassiz in 1906 was 38 bushels 23 lbs. per acre.

PEASE.

Twenty-four varieties of pease have been under trial at all the Experimental Farms during the past season. The plots were of the same size as those sown with spring wheat. The quantity of seed used per acre varied from 2 to 3 bushels, depending on the size of the pea. The dates of sowing were as follows: At Ottawa, Ont., May 7th; Nappan, N.S., May 22nd; Brandon, Man., April 30th; Indian Head, Sask., May 2nd, and at Agassiz, B.C., April 17th.

The yield is expressed in bushels per acre, the bushel of pease being 60 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Golden Vine	36	36	109	28	20	13	Early Britain	32	20	111	31	40
2	Mackay*	34	16	110	25	..	14	Agnes*	32	12	109	27	40
3	Prussian Blue	34	12	107	27	..	15	Pearl*	32	8	108	29	40
4	Chancellor	34	8	106	34	40	16	Prince Albert	32	4	110	24	40
5	Prince*	34	4	110	24	20	17	Kent*	31	56	111	25	..
6	English Grey	33	52	111	31	20	18	Arthur*	31	32	106	33	..
7	Victoria*	33	44	114	23	40	19	Archer*	31	20	112	29	40
8	Picton*	33	28	109	27	..	20	Duke*	31	16	110	28	20
9	White Wonder	33	28	105	19	..	21	Wisconsin Blue	30	16	109	26	40
10	Gregory*	33	4	112	27	40	22	Black-eye Marrowfat	29	48	111	27	..
11	Daniel O'Rourke	32	40	109	27	..	23	Nelson*	29	32	105	24	40
12	Paragon*	32	40	106	24	40	24	White Marrowfat	28	32	109	21	40

The average crop of the 24 varieties of pease tested on the Central Experimental Farm at Ottawa, in 1906, was 27 bus. 3 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Archer*	30	52	113	18	40	13	Daniel O'Rourke	26	28	110	19	..
2	Prince Albert	30	36	112	29	20	14	Paragon*	26	16	111	35	20
3	Agnes*	30	8	112	16	40	15	Duke*	25	56	112	23	..
4	Nelson*	29	36	111	18	40	16	Golden Vine	25	52	110	22	..
5	Chancellor	29	24	105	18	..	17	Prince*	25	52	113	30	..
6	White Marrowfat	29	..	111	24	..	18	Early Britain	25	12	109	28	..
7	Arthur*	28	40	109	17	20	19	Picton*	24	44	112	20	..
8	Gregory*	28	..	114	26	..	20	Pearl*	24	44	114	24	40
9	Victoria*	26	48	117	28	40	21	Wisconsin Blue	24	24	112	22	40
10	English Grey	26	48	112	14	40	22	Kent*	23	20	113	16	40
11	Mackay*	26	40	113	19	20	23	Prussian Blue	23	..	110	19	.
12	Black-eye Marrowfat	26	40	113	20	..	24	White Wonder	20	..	108	15	20

The average crop of the 24 varieties of pease tested on the Experimental Farm at Nappan, in 1906, was 21 bus. 57 lbs. per acre.

PEASE—*Continued.*

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Early Britain	53	32	125	48	20	13	Wisconsin Blue	45	46	125	46	20
2	Mackay*	52	..	130	50	..	14	Paragon*	45	34	125	50	..
3	Victoria*	50	8	132	46	40	15	Black-eye Marrowfat	45	20	123	58	20
4	Arthur*	49	38	123	48	20	16	Archer*	45	10	133	44	30
5	Picton*	49	18	127	43	40	17	Daniel O'Rourke	44	22	130	44	20
6	Gregory*	48	46	129	53	..	18	Prussian Blue	44	16	122	51	..
7	Pearl*	48	2	135	45	10	19	Nelson*	43	46	123	50	..
8	Golden Vine	47	42	124	44	50	20	Duke*	43	44	128	53	20
9	Prince*	47	24	132	53	40	21	Chancellor	43	24	117	51	40
10	English Grey	46	30	132	38	..	22	Kent*	42	56	133	39	..
11	White Marrowfat	46	28	131	51	20	23	Prince Albert	42	44	133	41	40
12	White Wonder	46	28	120	51	40	24	Agnes*	41	50	128	40	..

The average crop of the 24 varieties of pease tested on the Experimental Farm at Brandon in 1906 was 47 bushels, 42 lbs. per acre.

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Paragon*	52	4	117	39	..	13	Gregory*	46	30	117	34	40
2	Daniel O'Rourke	51	14	111	41	..	14	Kent*	46	18	119	39	..
3	Early Britain	51	6	115	45	20	15	Agnes*	46	6	115	30	..
4	Prussian Blue	50	22	115	41	..	16	Duke*	45	34	119	41	20
5	Chancellor	50	6	114	39	.	17	Arthur*	44	54	113	36	..
6	English Grey	49	34	115	37	40	18	Archer*	44	34	118	34	40
7	Picton*	48	34	115	36	20	19	Pearl*	44	26	116	36	..
8	Mackay*	48	18	119	38	..	20	Nelson*	44	6	115	38	40
9	Prince*	48	10	115	33	20	21	Wisconsin Blue	43	50	119	36	..
10	Black-eye Marrowfat	47	54	118	36	..	22	Prince Albert	42	6	116	45	40
11	Golden Vine	47	10	114	45	40	23	White Marrowfat	40	38	117	36	..
12	White Wonder	47	2	112	38	40	24	Victoria*	38	58	117	33	20

The average crop of the 24 varieties of pease tested on the Experimental Farm at Indian Head in 1906 was 38 bushels 1 lb. per acre.

PEASE—*Continued.*

EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1906.	
	(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years).	Bu.	Lbs.	Days.	Bu.	Lbs.
1	White Marrowfat....	43	54	116	49	..	13	Chancellor.....	36	38	117	34	40
2	Early Britain.....	42	14	112	48	40	14	Nelson *.....	36	26	115	36	..
3	English Grey.....	39	42	114	50	..	15	Picton *.....	35	40	117	46	40
4	Mackay *.....	38	42	116	43	..	16	Gregory *...	35	34	114	36	20
5	Prince *..	38	42	117	38	40	17	Agnes *.....	35	20	116	28	..
6	White Wonder.....	38	22	114	36	40	18	Daniel O'Rourke.....	35	2	111	37	40
7	Golden Vine.....	38	18	115	42	40	19	Wisconsin Blue.....	35	..	116	38	..
8	Arthur *..... ...	38	10	114	38	10	20	Black-eye Marrowfat.	34	30	116	26	..
9	Victoria.....	37	56	118	45	20	21	Duke *.....	33	58	121	29	40
10	Kent *.....	37	8	116	46	20	22	Pearl *.....	33	54	117	32	30
11	Paragon *..... ..	37	8	121	27	20	23	Archer *.....	33	48	117	39	..
12	Prince Albert.....	36	52	116	41	20	24	Prussian Blue..... .	33	28	114	35	20

The average crop of the 24 varieties of pease tested on the Experimental Farm at Agassiz in 1906 was 38 bushels 37 lbs. per acre.

INDIAN CORN.

The number of varieties of Indian corn tested in 1906 was twenty-three. These were sown in rows about three feet apart, and the plants thinned out to six or eight inches apart in the rows. The dates of sowing were as follows :—At Ottawa, Ont., May 28th ; Nappan, N.S., June 8th ; Brandon, Man., June 11th ; Indian Head, Sask., May 19th, and at Agassiz, B.C., May 4th.

The crop in each case was cut green and put into the silo for the winter feeding of stock. The dates of cutting were :—At Ottawa, Ont., Sept. 11th ; Nappan, N.S., Oct. 3rd ; Brandon, Man., Aug. 27th ; Indian Head, Sask., Sept. 13th, and at Agassiz, B.C., Oct. 2nd.

The yield per acre has been calculated in each case from the weight obtained from two rows each 66 feet long.

In Canada the ton is 2,000 lbs.

INDIAN CORN—*Continued.*

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties Tested.	Average yield.		Yield in 1906.		Number.	Varieties Tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons	Lbs.	Tons	Lbs.		(For five years).	Tons	Lbs.	Tons	Lbs.
1	Eureka	24	620	11	.....	15	Longfellow	19	82	12	310
2	Thoroughbred White Flint	22	1,276	12	1,740	16	North Dakota White	18	1,708	10	570
3	Superior Fodder	22	1,062	13	730	17	Champion White Pearl	18	1,543	10	1,450
4	Giant Prolific Ensilage	22	1,023	13	840	18	Cloud's Early Yellow	18	1,400	8	1,160
5	Early Butler	21	1,516	14	1,590	19	Evergreen Sugar	17	1,882	11	1,210
6	Red Cob Ensilage	21	1,274	13	1,940	20	Angel of Midnight	16	1,102	7	1,290
7	Early Mastodon	21	1,219	14	1,920						
8	Salzer's All Gold	21	1,032	8	1,600		(For less than 5 years).				
9	Pride of the North	20	1,162	7	1,290						
10	Mammoth Cuban	20	854	13	1,720						
11	Compton's Early	19	1,941	11	1,320		Wood's Northern Dent (1 year)	.....		15	690
12	Selected Leaming	19	1,754	14	50		Early Leaming (1 year)	.....		13	950
13	King Philip	19	1,358	11	110		Early Longfellow (1 year)	.....		11	.....
14	White Cap Yellow Dent	19	676	7	190						

The average crop of the 23 varieties of Indian corn tested on the Central Experimental Farm at Ottawa in 1906 was 11 tons, 1,420 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Thoroughbred White Flint	22	858	25	160	15	King Philip	18	488	18	1,900
2	Eureka	22	594	23	1,850	16	Mammoth Cuban	17	1,410	18	800
3	Red Cob Ensilage	21	42	19	1,270	17	White Cap Yellow Dent	17	1,156	18	1,400
4	Salzer's All Gold	20	1,624	17	650	18	Cloud's Early Yellow	17	618	20	920
5	Giant Prolific Ensilage	20	1,580	20	1,800	19	North Dakota White	17	540	20	1,800
6	Early Mastodon	20	260	25	600	20	Champion White Pearl	17	474	21	20
7	Longfellow	19	1,772	19	1,600						
8	Superior Fodder	19	1,160	18	1,950		(For less than 5 years).				
9	Pride of the North	19	560	17	1,750						
10	Compton's Early	19	38	21	900						
11	Angel of Midnight	18	1,988	24	1,500		Early Leaming (1 year)	.....		22	550
12	Evergreen Sugar	18	1,796	22	330		Early Longfellow (1 year)	.....		18	950
13	Early Butler	18	1,510	19	170		Wood's Northern Dent (1 year)	.....		16	450
14	Selected Leaming	18	1,136	20	1,250						

The average crop of the 23 varieties of Indian corn tested on the Experimental Farm at Nappan in 1906 was 20 tons, 1,068 lbs. per acre.

INDIAN CORN—*Continued.*

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Thoroughbred White Flint	21	425	21	1,296	15	Early Mastodon	17	637	18	168
2	Superior Fodder..	20	1,237	19	1,600	16	Mammoth Cuban.....	16	578	15	624
3	Eureka.....	20	1,022	18	960	17	White Cap Yellow Dent ..	15	1,838	13	1,984
4	Longfellow.....	20	920	21	768	18	Cloud's Early Yellow	15	1,680	19	1,072
5	Champion White Pearl...	19	1,811	21	1,560	19	Selected Leaming.....	15	888	14	1,304
6	Angel of Midnight.....	19	966	19	280	20	Evergreen Sugar.....	13	770	14	248
7	Compton's Early.....	19	755	19	808						
8	North Dakota White. ...	18	1,752	19	16		(For less than 5 years).				
9	Early Butler.....	18	1,752	19	544						
10	Salzer's All Gold.....	18	1,541	18	960						
11	King Philip	18	802	18	698		Early Longfellow (1 year) .	.....		18	168
12	Red Cob Ensilage.....	18	749	18	432		Early Leaming (1 year)....	....	....	16	472
13	Pride of the North	17	1,482	17	848		Wood's Northern Dent (1 year).....	.....		15	624
14	Giant Prolific Ensilage ...	17	1,376	16	1,000						

The average crop of the 23 varieties of Indian corn tested on the Experimental Farm at Brandon in 1906 was 18 tons, 19 lbs. per acre.

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Angel of Midnight....	16	604	15	800	14	White Cap Yellow Dent	12	891	11	550
2	Thor'bred White Flint	15	1,882	15	1,570	15	Early Butler.....	12	816	13	620
3	Eureka....	15	975	16	1,000	16	Selected Leaming.....	11	1,272	14	710
4	Salzer's All Gold.....	15	580	11	1,650	17	Early Mastodon.....	11	1,135	14	1,920
5	Compton's Early.....	14	1,674	12	1,850	18	Mammoth Cuban.. ..	11	317	11	....
6	Pride of the North....	14	486	15	1,020	19	Evergreen Sugar.....	11	312	14	50
7	North Dakota White..	14	367	13	1,500	20	Cloud's Early Yellow..	10	478	13	1,500
8	King Philip	14	50	12	1,630						
9	Champion White Pearl	13	1,177	15	800		(For less than 5 years)				
10	Giant Prolific Ensilage	13	334	14	1,700						
11	Longfellow....	13	193	14	160		Early Longfellow (1 yr)	.....		14	50
12	Red Cob Ensilage.....	12	1,766	14	1,150		Early Leaming (1 yr.)	.....		11	1,870
13	Superior Fodder.....	12	1,538	11	....		Wood's Northern Dent (1 yr.).....	.....		10	1,340

The average crop of the 23 varieties of Indian corn tested on the Experimental Farm at Indian Head, in 1906 was 13 tons 1,280 lbs. per acre.

INDIAN CORN—*Continued.*

EXPERIMENTAL FARM AT AGASSIZ, B. C.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Thoroughbred White Flint	23	1,630	18	1,620	14	North Dakota White	16	1,132	16	560
2	Pride of the North	23	1,232	21	1,280	15	Eureka	16	76	13	620
3	Red Cob Ensilage	21	1,120	20	1,580	16	King Philip	15	1,988	14	1,260
4	Superior Fodder	21	88	19	1,490	17	Cloud's Early Yellow	15	18	12	90
5	Giant Prolific Ensilage	20	1,492	20	40	18	Longfellow	14	1,854	13	1,280
6	Mammoth Cuban	20	260	17	1,530	19	Selected Leaming	13	1,852	11	220
7	Salzer's All Gold	20	242	18	1,310	20	Evergreen Sugar	12	1,678	11	1,760
8	Compton's Early	19	801	17	1,805		(For less than 5 years).				
9	Early Butler	18	1,664	17	980						
10	Champion White Pearl	18	740	17	1,860		Wood's Northern Dent (1 yr.)	.....		16	1,600
11	Early Mastodon	17	1,110	14	700		Early Longfellow (1yr.)	.....		12	310
12	Angel of Midnight	17	122	14	1,040		Early Leaming (1 yr.)	.....		11	1,430
13	White Cap Yellow Dent	17	34	19	280						

The average crop of the 23 varieties of Indian corn tested on the Experimental Farm at Agassiz in 1906 was 16 tons 632 lbs. per acre.

TURNIPS.

Twenty varieties were tested in 1906, sown in drills, or on the flat, 2½ feet apart. The dates of sowing were as follows:—Ottawa, Ont. May 15th; Nappan, N.S., June 16th; Brandon, Man., May 22nd; Indian Head, Sask., June 14th* and at Agassiz, May 7th.

The dates of pulling were as follows:—Ottawa, October 24th; Nappan, October 24th; Brandon, October 11th; Indian Head, October 10th and at Agassiz November 1st.

The yield per acre in each instance has been calculated from the weight of roots gathered from two rows each 66 feet long. This applies to all the field roots.

In Canada the ton is 2,000 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Jumbo	36	637	16	150	11	Imperial Swede	31	571	17	500
2	New Century	36	340	22	300	12	Halewood's Bronze Top	31	351	15	1,150
3	Kangaroo	35	1,052	15	1,700	13	Hall's Westbury	30	1,887	16	1,650
4	Mammoth Clyde	35	281	19	600	14	Selected Purple Top	30	382	19	300
5	Good Luck	34	1,095	13	1,550	15	East Lothian	29	987	11	..
6	Emperor Swede	33	648	12	1,950	16	Drummond Purple Top	29	886	10	1,550
7	Magnum Bonum	33	157	15	850	17	Skirvings	29	170	18	800
8	Perfection Swede	32	870	21	300	18	Carter's Elephant	28	1,391	14	100
9	Hartley's Bronze	31	837	15	1,500	19	Sutton's Champion	27	1,485	17	1,000
10	Elephant's Master	31	620	14	50	20	Bangholm Selected	27	1,013	11	1,800

The average yield of the 20 varieties of turnips tested on the Central Experimental Farm at Ottawa in 1906 was 15 tons 1,890 lbs. per acre.

*At Indian Head the first two sowings of May 11th and 19th were destroyed by cut worms, the crops recorded were grown from a third sowing made on June 13th.

TURNIPS—*Continued.*

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede.....	40	1,920	26	800	11	Jumbo.....	37	986	20	..
2	Magnum Bonum.....	40	680	24	1,600	12	Hall's Westbury.....	37	962	26	1,440
3	Kangaroo.....	38	1,922	28	1,840	13	Carter's Elephant.....	37	549	22	.
4	Selected Purple Top..	38	1,127	26	1,600	14	Sutton's Champion ...	36	1,854	25	400
5	Good Luck.....	38	1,022	23	1,680	15	Mammoth Clyde	36	1,482	24	1,280
6	Hartley's Bronze	38	1,016	27	240	16	Imperial Swede.....	36	612	26	1,600
7	Drummond Purple Top	38	369	26	160	17	Bangholm Selected ...	35	1,988	21	400
8	Elephant's Master.. .	37	1,503	23	1,040	18	New Century.....	35	1,605	30	160
9	Halewood's Bronze Top	37	1,285	26	320	19	Skirvings	35	1,006	21	1,200
10	Emperor Swede	37	1,195	23	560	20	East Lothian.....	34	189	20	1,920

The average yield of the 20 varieties of turnips tested on the Experimental Farm at Nappan in 1906 was 25 tons 612 lbs. per acre.

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Hartley's Bronze	31	787	26	1,856	11	New Century.....	26	483	19	16
2	Good Luck.....	30	1,670	25	952	12	Imperial Swede.....	26	378	22	880
3	Magnum Bonum.....	29	819	23	1,784	13	Elephant's Master ...	26	378	20	1,448
4	Bangholm Selected ...	28	1,299	25	424	14	Drummond Purple Top	25	1,797	18	1,488
5	Sutton's Champion ...	28	549	26	1,592	15	Emperor Swede	25	1,533	22	88
6	Hall's Westbury	27	1,062	25	1,744	16	Halewood's Bronze Top	25	1,163	19	544
7	Jumbo...	27	648	24	576	17	Mammoth Clyde	25	956	21	1,560
8	Skirvings.....	27	437	18	696	18	Kangaroo.....	25	952	21	1,032
9	Carter's Elephant.....	26	1,962	24	48	19	East Lothian.....	25	688	20	392
10	Perfection Swede.....	26	1,539	20	1,976	20	Selected Purple Top..	25	582	20	1,184

The average yield of the 20 varieties of turnips tested on the Experimental Farm at Brandon in 1906 was 22 tons 814 lbs. per acre.

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Sutton's Champion....	24	1,038	15	228	11	Emperor Swede	21	198	14	1,172
2	Hall's Westbury.....	23	1,154	20	1,052	12	Jumbo..... .	20	1,667	13	1,588
3	Perfection Swede.....	23	954	21	900	13	Magnum Bonum	20	1,594	19	1,864
4	Halewood's Bronze Top	23	728	16	208	14	Drummond Purple Top	20	919	13	1,984
5	Hartley's Bronze	22	1,961	22	1,408	15	Mammoth Clyde.....	20	52	17	320
6	Skirvings.....	22	426	16	208	16	New Century.....	20	42	15	1,944
7	Bangholm Selected ...	21	1,975	21	636	17	Selected Purple Top.	19	892	15	756
8	Carter's Elephant.....	21	924	16	1,660	18	Kangaroo.....	18	726	16	472
9	Good Luck.....	21	663	16	1,396	19	Elephant's Master....	18	647	16	1,924
10	Imperial Swede	21	638	16	1,924	20	East Lothian.....	18	445	15	1,020

The average yield of the 20 varieties of turnips tested on the Experimental Farm at Indian Head in 1906 was 17 tons 333 lbs. per acre.

TURNIPS—*Continued.*

EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Carter's Elephant.....	28	1,664	15	1,680	11	Hall's Westbury.....	25	1,480	13	928
2	Perfection Swede.....	28	995	20	1,760	12	Imperial Swede.....	25	1,025	18	432
3	Halewood's Bronze Top	27	1,683	21	240	13	Bangholm Selected...	25	908	14	488
4	Mammoth Clyde	27	556	10	1,120	14	Kangaroo.....	25	530	21	1,032
5	Elephant's Master ...	26	1,820	16	208	15	Magnum Bonum.....	25	61	17	1,376
6	East Lothian.....	26	1,311	14	1,172	16	Skirvings.....	24	1,762	13	664
7	Good Luck.....	26	793	23	200	17	Drummond Purple Top	23	1,673	15	1,152
8	Hartley's Bronze.....	26	536	12	552	18	New Century.....	23	840	16	142
9	Jumbo	25	1,875	21	600	19	Selected Purple Top .	22	1,223	11	1,760
10	Emperor Swede.....	25	1,750	18	960	20	Sutton's Champion...	21	1,243	15	1,944

The average yield of the 20 varieties of turnips tested on the Experimental Farm at Agassiz in 1906 was 16 tons 1,220 lbs. per acre.

MANGELS.

Sixteen varieties of mangels have been under test during 1906. All were sown in drills or on the flat in rows 2½ feet apart. The dates of sowing were as follows :—At Ottawa, Ont., May 15th ; Nappan, N.S., June 14th ; Brandon, Man., May 23rd Indian Head, Sask., June 13th*, and at Agassiz, B.C., April 21.

The dates of pulling were as follows :—At Ottawa, Ont., Oct. 24th ; Nappan, N.S. Oct. 17th ; Brandon, Man., Oct. 8th ; Indian Head, Sask., Oct. 8th, and at Agassiz Oct. 30th.

In Canada the ton is 2,000 lbs.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Mammoth Long Red..	41	803	38	800	8	Yellow Intermediate.	36	879	37	1,050
2	Mammoth Yellow Intermediate.....	39	1,680	33	800	9	Selected Yellow Globe	35	56	34	900
3	Prize Mammoth Long Red.....	38	1,853	35	600	10	Giant Sugar Mangel .	34	991	30	1,600
4	Half Sugar White.....	37	1,527	25	700	11	Selected Mammoth Long Red	33	954	40	1,550
5	Triumph Yellow Globe	37	1,476	36	700	12	Leviathan Long Red.	33	648	28	400
6	Prize Winner Yellow Globe.....	37	1,087	33	200	13	Giant Yellow Intermediate	32	1,060	29	1,250
7	Lion Yellow Intermediate	36	1,146	32	300	14	Gate Post.....	32	424	24	1,500
						15	Half Sugar Rosy.....	31	118	27	700
						16	Giant Yellow Globe..	30	1,122	21	50

The average yield of the 16 varieties of mangels tested on the Central Experimental Farm at Ottawa in 1906 was 31 tons 1,569 lbs. per acre.

*At Indian Head the first two sowings of May 11th and 19th were destroyed by cut worms. The crops recorded were grown from a third sowing made on June 13th.

MANGELS—*Continued.*

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average yield.	Yield in 1906.	Number.	Varieties tested.	Average yield.	Yield in 1906.
	(For five years.)	Tons. Lbs.	Tons. Lbs.		(For five years.)	Tons. Lbs.	Tons. Lbs.
1	Mammoth Yellow Intermediate...	35 1,142	17 1,145	8	Prize Mamm. Long Red.	30 999	16 1,495
2	Lion Yellow Intermediate	35 763	16 670	9	Giant Yellow Globe. ..	29 1,531	13 730
3	Yellow Intermediate....	33 1.477	19 940	10	Mammoth Long Red....	29 192	18 465
4	Giant Yellow Intermediate	33 910	13 235	11	Half Sugar Rosy.....	28 1,959	14 1,205
5	Prize Winner Yellow Globe.....	33 269	16 1,990	12	Selected Mamm. Long Red.	28 819	13 1720
6	Selected Yellow Globe..	32 728	18 960	13	Triumph Yellow Globe..	28 53	14 1700
7	Half Sugar White	31 1,261	19 280	14	Leviathan Long Red....	27 1,943	15 855
				15	Giant Sugar Mangel....	27 979	13 565
				16	Gate Post.....	26 1,971	13 1,555

The average yield of the 16 varieties of mangels tested on the Experimental Farm at Nappan in 1906 was 15 tons, 1,907 lbs. per acre.

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average yield.	Yield in 1906.	Number.	Varieties tested.	Average yield.	Yield in 1906.
	(For five years.)	Tons. Lbs.	Tons. Lbs.		(For five years.)	Tons. Lbs.	Tons. Lbs.
1	Mammoth Long Red....	30 826	27 384	9	Gate Post	27 806	26 1,064
2	Triumph Yellow Globe..	29 1,294	38 296	10	Lion Yellow Intermediate.....	26 1,486	21 636
3	Prize Mamm. Long Red.	29 872	32 1,472	11	Selected Yellow Globe ..	26 1,381	32 416
4	Half Sugar White	29 502	31 304	12	Half Sugar Rosy.....	26 1,354	28 1,288
5	Selected Mamm. Long Red....	29 398	29 1,400	13	Leviathan Long Red....	25 182	26 272
6	Prize Winner Yellow Globe	29 368	33 264	14	Giant Yellow Intermediate	24 1,711	25 1,744
7	Yellow Intermediate ...	29 238	31 1,624	15	Giant Sugar Mangel	24 946	26 1,856
8	Mammoth Yellow Intermediate	28 1,024	26 1,856	16	Giant Yellow Globe....	23 306	24 312

The average yield of the 16 varieties of mangels tested on the Experimental Farm at Brandon in 1906 was 28 tons, 1,824 lbs. per acre.

MANGELS—*Continued.*

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Prize Winner Yellow Globe	26	1,120	27	252	8	Giant Yellow Globe	23	617	24	180
2	Triumph Yellow Globe	25	1,652	28	232	9	Half Sugar Rosy	21	1,603	21	1,296
3	Giant Yellow Intermediate	25	942	24	972	10	Giant Sugar Mangel	21	1,222	20	1,845
4	Lion Yellow Intermediate	25	875	21	636	11	Prize Mamm. Long Red.	21	917	19	544
5	Selected Yellow Globe	24	1,037	22	1,804	12	Mammoth Long Red	21	633	21	900
6	Half Sugar White	24	650	23	596	13	Selected Mammoth Long Red	21	552	19	1,336
7	Yellow Intermediate	23	1,516	23	728	14	Leviathan Long Red	20	1,751	21	636
						15	Gate Post	20	1,162	18	1,092

Fifteen varieties only were sown at Indian Head, the Mammoth Yellow Intermediate being accidentally omitted.

The average yield of the 15 varieties of mangels tested on the Experimental Farm at Indian Head in 1906 was 22 tons, 1,003 lbs. per acre.

EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Mammoth Long Red	31	1,235	14	644	9	Selected Mamm. Long Red	25	1,612	14	1,010
2	Lion Yellow Intermediate	28	1,332	15	1,680	10	Mammoth Yellow Intermediate	25	721	20	1,712
3	Yellow Intermediate	28	1,263	27	852	11	Half Sugar Rosy	25	606	18	168
4	Giant Sugar Mangel	28	397	18	960	12	Prize Mamm. Long Red.	24	1,102	11	1,892
5	Half Sugar White	28	239	16	868	13	Triumph Yellow Globe	23	1,422	20	1,184
6	Giant Yellow Globe	27	1,361	11	1,760	14	Gate Post	23	840	10	856
7	Selected Yellow Globe	26	510	11	1,826	15	Leviathan Long Red	22	1,724	19	544
8	Giant Yellow Intermediate	26	371	13	1,720	16	Prize Winner Yellow Globe	22	1,593	11	176

The average yield of the 16 varieties of mangels tested on the Experimental Farm at Agassiz in 1906 was 16 tons, 118 lbs. per acre.

CARROTS.

Ten different sorts of carrots were tested during 1906, all being sown in drills, on the flat, in rows two feet apart. The dates of sowing were as follows:—At Ottawa, Ont., May 15th; Nappan, N.S., June 4th; Brandon, Man, May 8th; Indian Head, Sask., June 13th; and at Agassiz, B.C., April 21st.

The dates of pulling were as follows:—At Ottawa, Oct. 25th; Nappan, Oct. 20th; Brandon, Oct. 10th; Indian Head, Oct. 9th; and at Agassiz, Oct. 31st.

In Canada the ton is 2,000 lbs.

CARROTS—*Continued.*

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Mammoth White Intermediate..	29	1,227	25	1,950	6	Carter's Orange Giant.	24	697	16	1,600
2	New White Intermediate.....	28	57	20	900	7	Long Yellow Stump-rooted	23	616	20	1,300
3	Improved Short White	27	1,976	25	1,200	8	White Belgian.....	21	481	15	1,200
4	Giant White Vosges..	27	1,581	21	900	9	Half Long Chantenay.	20	91	14	1,200
5	Ontario Champion....	27	188	21	1,000	10	Early Gem.....	19	601	15	800

The average yield of the 10 varieties of carrots tested on the Central Experimental Farm at Ottawa in 1906 was 19 tons 1,605 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Ontario Champion....	19	1,611	12	420	6	Long Yellow Stump-rooted..	17	1,738	10	625
2	New White Intermediate..	19	1,511	15	1,515	7	Improved Short White	17	919	9	150
3	Mammoth White Intermediate..	19	960	8	665	8	Half Long Chantenay.	17	73	10	995
4	Giant White Vosges..	19	824	10	460	9	Carter's Orange Giant.	16	957	10	130
5	White Belgian..	18	199	13	70	10	Early Gem.	15	1,453	9	1,305

The average yield of the 10 varieties of carrots tested on the Experimental Farm at Nappan in 1906 was 10 tons 1,833 lbs. per acre.

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	New White Intermediate.....	24	576	18	960	7	Mammoth White Intermediate	19	412	18	80
2	Ontario Champion....	23	816	19	720	8	Long Yellow Stump-rooted	19	236	20	480
3	Improved Short White	23	24	19	1,160	9	Half Long Chantenay.	17	1,792	18	1,400
4	Giant White Vosges..	20	1,448	20	1,360	10	Early Gem.....	17	1,288	20	40
5	Carter's Orange Giant.	20	832	21	1,120						
6	White Belgian.....	19	632	14	160						

The average yield of the 10 varieties of carrots tested on the Experimental Farm at Brandon in 1906 was 19 tons 148 lbs. per acre.

CARROTS—*Continued.*

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Number.	Varieties tested.	Average yield.	
	(For five years ending 1905.)	Tons.	Lbs.		(For five years ending 1905.)	Tons.	Lbs.
1	Ontario Champion	16	113	6	Early Gem	13	47
2	New White Intermediate	15	1,562	7	Half Long Chantenay	12	1,730
3	Giant White Vosges	14	1,464	8	Mammoth White Intermediate	12	1,694
4	Improved Short White	14	402	9	Carter's Orange Giant	12	749
5	White Belgian	13	426	10	Long Yellow Stump-rooted	12	274

The plots of carrots at Indian Head in 1906 were entirely destroyed by cutworms. Under these circumstances it is thought best to give the yields for the five years ending 1905.

EXPERIMENTAL FARM, AGASSIZ, B. C.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Giant White Vosges	31	456	37	1,340	6	New White Intermediate	24	1,309	28	1,948
2	Mamm. White Intermediate	28	678	26	1,592	7	Ontario Champion	24	554	23	1,784
3	Improved Short White	27	105	31	964	8	Early Gem	20	1,796	24	576
4	White Belgian	26	331	28	232	9	Long Yellow Stump Rooted	20	814	22	1,672
5	Carter's Orange Giant	25	1,097	31	1,756	10	Half Long Chantenay	19	1,684	26	404

The average yield of the 10 varieties of carrots tested on the Experimental Farm at Agassiz in 1906 was 28 tons 427 lbs. per acre.

SUGAR BEETS.

Eight varieties of sugar beets have been tested during 1906, sown in drills or on the flat in rows two feet apart. The dates of sowing were: At Ottawa, Ont., May 15th; Nappan, N.S., June 14th; Brandon, Man., May 23rd; Indian Head, Sask., June 13th and at Agassiz, B.C., April 21st.

The dates of pulling were as follows: At Ottawa Oct. 25th; Nappan, October 19th; Brandon, October 8th; Indian Head, October 9th and at Agassiz, October 30th.

The yield per acre in each instance has been calculated from the weight of roots gathered from two rows each 66 feet long. Though all the varieties included in these tests are commonly classed as sugar beets it should be noted that the only sorts recommended for use in the manufacture of beet sugar are Wanzleben, Vilmorin's Improved and French Very Rich.

In Canada the ton is 2,000 lbs.

SUGAR BEETS—*Continued.*

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Danish Red Top.....	34	1,919	35	50	5	Royal Giant.....	30	624	31	1,350
2	Red Top Sugar.....	34	1,611	33	350	6	Wanzleben.....	26	853	26	1,700
3	Danish Improved.....	33	1,392	31	1,950	7	French Very Rich....	24	649	28	300
4	Improved Imperial...	32	452	34	150	8	Vilmorin's Improved..	23	1,387	25	800

The average yield of the 8 varieties of sugar beets tested on the Central Experimental Farm at Ottawa in 1906 was 30 tons 1,581 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N. S.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Royal Giant.....	27	991	10	295	5	Improved Imperial....	23	790	12	1,410
2	Red Top Sugar.....	24	1,796	9	975	6	Wanzleben..	20	246	8	830
3	Danish Red Top.....	24	1,218	11	1,430	7	Vilmorin's Improved.	18	1,180	8	1,490
4	Danish Improved.....	23	1,269	13	1,225	8	French Very Rich....	16	1,641	11	605

The average yield of the 8 varieties of sugar beets tested on the Experimental Farm at Nappan in 1906 was 10 tons 1,532 lbs. per acre.

EXPERIMENTAL FARM BRANDON, MAN.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Red Top Sugar.....	26	1,856	20	1,448	5	Improved Imperial.....	21	187	21	1,824
2	Danish Red Top.....	25	1,770	26	800	6	Wanzleben.....	19	1,706	16	1,792
3	Royal Giant.....	21	1,982	22	1,672	7	French Very Rich	16	525	16	1,264
4	Danish Improved.....	21	926	20	920	8	Vilmorin's Improved.....	15	571	15	624

The average yield of the 8 varieties of sugar beets tested on the Experimental Farm at Brandon in 1906 was 20 tons, 293 lbs. per acre.

SUGAR BEETS—*Continued.*

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Royal Giant	20	7	19	148	5	Danish Red Top	15	1,420	16	1,000
2	Red Top Sugar	18	71	14	1,568	6	Vilmorin's Improved	13	1,172	10	856
3	Danish Improved	16	1,672	16	472	7	Wanzleben	13	180	11	308
4	Improved Imperial	16	1,472	15	888	8	French Very Rich	12	1,537	9	480

The average yield of the 8 varieties of sugar beets tested on the Experimental Farm at Indian Head in 1906 was 14 tons, 215 lbs. per acre.

EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Tons.	Lbs.	Tons.	Lbs.		(For five years).	Tons.	Lbs.	Tons.	Lbs.
1	Royal Giant	23	1,197	15	1,680	5	Danish Red Top	20	1,686	21	1,032
2	Improved Imperial	21	1,930	22	1,540	6	French Very Rich	17	1,533	12	1,080
3	Danish Improved	21	1,280	19	1,072	7	Wanzleben	17	637	18	1,356
4	Red Top Sugar	21	709	20	1,712	8	Vilmorin's Improved	17	185	10	64

The average yield of the 8 varieties of sugar beets tested on the Experimental Farm at Agassiz in 1906 was 17 tons, 1,442 lbs. per acre.

POTATOES.

Thirty-two varieties of potatoes have been under test during 1906. The potatoes were cut into pieces with two or three eyes in each, and these pieces were planted in rows 2½ feet apart, the sets being placed a foot apart in the rows. The dates of planting and digging were as follows:—At Ottawa, Ont., planted May 22, dug Oct. 1st; at Nappan, N.S., planted June 13, dug October 12; at Brandon, Man., planted May 21, dug October 2; at Indian Head, Sask., planted May 12, dug October 3, and at Agassiz, B.C., planted May 1, dug September 17.

In Canada the bushel of potatoes is 60 lbs.

POTATOES—*Continued.*

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Bus.	Lbs.	Bus.	Lbs.		(For five years).	Bus.	Lbs.	Bus.	Lbs.
1	Carman No. 1	387	38	114	24	18	Empire State	297	..	132	..
2	Late Puritan	375	19	116	36	19	Maule's Thoroughbred	294	48	105	36
3	Money Maker	362	7	74	48	20	American Wonder	286	53	79	12
4	Dreer's Standard	357	17	121	..	21	Early Rose	283	48	149	36
5	Burnaby Mammoth	350	41	94	36	22	Carman No. 3	270	36	88	..
6	Sabean's Elephant	349	22	129	48	23	Early White Prize	210	19	156	12
7	Canadian Beauty	348	55	112	12	24	Bovee	209	26	112	12
8	I. X. L.	346	43	112	12		(For less than 5 years).				
9	Holborn Abundance	333	31	171	36		Pearce (4 yrs.)	310	45	143	..
10	Irish Cobbler	330	53	132	..		Early Envoy (4 yrs.)	190	51	70	24
11	Rochester Rose	330	53	149	36		Pingree (4 yrs.)	182	36	134	12
12	Reeve's Rose	326	29	114	24		Dooley (2 yrs.)	253	..	149	36
13	Country Gentleman	326	2	165	..		Morgan Seedling (2 yrs.)	247	30	121	..
14	Vick's Extra Early	318	7	134	12		Vermont Gold Coin (2 yrs.)	243	6	138	36
15	Uncle Sam	317	14	116	36		Dalmeny Beauty (1 yr.)	...	..	213	24
16	State of Maine	315	29	132	..		Ashleaf Kidney (1 yr.)	...	..	151	48
17	Everett	310	12	88	..						

The average crop of the 32 varieties of potatoes tested on the Central Experimental Farm at Ottawa in 1906 was 125 bushels 45 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N.S.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Bus.	Lbs.	Bus.	Lbs.		(For five years).	Bus.	Lbs.	Bus.	Lbs.
1	Vick's Extra Early	455	50	385	..	18	Bovee	323	24	297	..
2	Rochester Rose	406	..	358	36	19	American Wonder	319	..	323	24
3	Irish Cobbler	371	16	367	24	20	Country Gentleman	318	7	330	..
4	State of Maine	369	36	422	24	21	Maule's Thoroughbred	317	41	242	..
5	I. X. L.	368	43	321	12	22	Dreer's Standard	305	22	266	10
6	Everett	367	..	286	..	23	Early Rose	282	29	336	36
7	Carman No. 1	365	12	396	..	24	Reeve's Rose	276	19	248	36
8	Late Puritan	361	41	341	..		(For less than 5 years).				
9	Canadian Beauty	359	55	336	36						
10	Empire State	355	5	343	12		Pearce (4 yrs.)	431	12	356	24
11	Money Maker	354	24	356	24		Early Envoy (4 yrs.)	343	12	380	36
12	Holborn Abundance	354	12	281	36		Pingree (4 yrs.)	331	31	297	..
13	Burnaby Mammoth	352	53	334	24		Vermont Gold Coin (2 yrs.)	508	12	503	48
14	Carman No. 3	340	7	418	..		Dooley (2 yrs.)	416	54	420	12
15	Early White Prize	339	41	330	..		Morgan Seedling (2 yrs.)	390	30	297	..
16	Uncle Sam	335	17	369	36		Ashleaf Kidney (1 yr.)	...	..	387	12
17	Sabean's Elephant	323	50	426	48		Dalmeny Beauty (1 yr.)	...	..	281	36

The average crop of the 32 varieties of potatoes tested on the Experimental Farm at Nappan in 1906 was 345 bushels 3 lbs. per acre.

POTATOES—*Continued.*

EXPERIMENTAL FARM, BRANDON, MAN.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Bus.	Lbs.	Bus.	Lbs.		(For five years).	Bus.	Lbs.	Bus.	Lbs.
1	American Wonder	545	36	484	..	19	Everett	397	28	359	20
2	Dreer's Standard	533	40	436	20	20	Early White Prize	394	32	256	40
3	Late Puritan	533	20	421	40	21	Bovee	374	..	407	..
4	State of Maine	529	28	484	..	22	Early Rose	358	58	289	40
5	Uncle Sam	522	8	469	20	23	Vick's Extra Early	353	28	260	20
6	Empire State	517	..	429	..	24	Rochester Rose	344	40	337	20
7	Money Maker	516	16	418	..						
8	Maule's Thoroughbred	504	32	403	20		(For less than 5 years).				
9	Sabean's Elephant	492	48	436	20						
10	Canadian Beauty	489	52	337	20		Pearce, (4 yrs.)	512	25	447	20
11	Country Gentleman	487	40	300	40		Early Envoy (4 yrs.)	388	40	392	20
12	Reeve's Rose	470	48	491	20		Pingree (4 yrs.)	270	25	278	40
13	Holborn Abundance	470	48	374	..		Morgan Seedling (2 yrs.)	586	40	443	40
14	Burnaby Mammoth	462	..	392	20		Vermont Gold Coin (2 yrs).	559	10	495	..
15	Irish Cobbler	459	48	385	..		Dooley (2 yrs)	383	10	363	..
16	Carman No. 3	447	20	344	40		Ashleaf Kidney (1 yr)	...	..	341	..
17	I. X. L.	447	20	414	20		Dalmeny Beauty (1 yr)	...	..	311	40
18	Carman No. 1	432	40	451	..						

The average crop of the 32 varieties of potatoes tested on the Experimental Farm at Brandon in 1906 was 389 bushels 14 lbs. per acre.

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years).	Bus.	Lbs.	Bus.	Lbs.		(For five years.)	Bus.	Lbs	Bus.	Lbs.
1	Country Gentleman	408	26	387	12	19	I. X. L.	357	31	334	24
2	Uncle Sam	403	36	299	12	20	Canadian Beauty	356	5	380	36
3	Late Puritan	403	15	360	48	21	Irish Cobbler	341	35	332	12
4	Burnaby Mammoth	394	27	345	24	22	Early White Prize	327	16	305	48
5	Carman No. 1	394	25	228	48	23	Early Rose	319	49	294	48
6	Rochester Rose	394	6	332	12	24	Bovee	289	57	259	36
7	Carman No. 3	391	45	402	36						
8	Sabean's Elephant	391	22	367	24		(For less than 5 years).				
9	American Wonder	389	31	332	12						
10	Reeve's Rose	388	44	321	12		Early Envoy (4 yrs.)	369	58	321	12
11	Money Maker	385	18	433	24		Pearce (4 yrs)	349	4	316	48
12	Dreer's Standard	381	46	358	36		Pingree (4 yrs)	319	55	224	24
13	Maule's Thoroughbred	379	13	323	24		Vermont Gold Corn (2 yrs.)	493	6	360	48
14	State of Maine	377	38	352	..		Morgan Seedling (2 yrs.)	388	36	290	24
15	Vick's Extra Early	377	12	369	36		Dooley (2 yrs.)	316	..	277	12
16	Empire State	374	23	347	36		Dalmeny Beauty (1 yr.)	...	..	406	30
17	Holborn Abundance	368	40	292	36		Ashleaf Kidney (1 yr.)	...	..	371	20
18	Everett	362	35	308	..						

The average crop of the 32 varieties of potatoes tested on the Experimental Farm at Indian Head in 1906 was 322 bushels 27 lbs. per acre.

POTATOES—*Concluded.*

EXPERIMENTAL FARM, AGASSIZ, B.C.

Number.	Varieties tested.	Average yield.		Yield in 1906.		Number.	Varieties tested.	Average yield.		Yield in 1906.	
	(For five years.)	Bus.	Lbs.	Bus.	Lbs.		(For five years.)	Bus.	Lbs.	Bus.	Lbs.
1	Late Puritan	460	14	611	36	20	Vick's Extra Early	327	8	281	36
2	American Wonder	444	41	508	12	21	Early White Prize	319	40	330	..
3	Uncle Sam	426	8	360	48	22	Carman No. 3	309	6	330	..
4	Dreer's Standard	410	13	589	36	23	Money Maker	293	22	211	12
5	Rochester Rose	406	59	452	..	24	Canadian Beauty	282	49	171	36
6	Country Gentleman	405	1	272	48		(For less than 5 years.)				
7	State of Maine	400	11	466	24		Pearce (4 years)	333	4	297	..
8	Carman No. 1	398	55	404	48		Early Envoy (4 years)	220	55	218	56
9	Empire State	392	29	356	24		Pingree (4 years)	201	40	200	12
10	Sabean's Elephant	390	34	435	36		Vermont Gold Coin (2 years)	539	..	514	48
11	I. X. L.	381	11	396	..		Dooley (2 years)	462	..	268	24
12	Reeve's Rose	375	6	218	56		Morgan Seedling (2 years)	414	42	363	..
13	Holborn Abundance	367	11	336	36		Ashleaf Kidney (1 year)	..	..	495	..
14	Maule's Thoroughbred	365	5	402	36		Dalmeny Beauty (1 year)	..	..	277	12
15	Everett	342	3	453	12						
16	Irish Cobbler	339	1	248	36						
17	Early Rose	338	15	264	..						
18	Bovee	337	40	264	..						
19	Burnaby Mammoth	329	32	323	24						

The average crop of the 32 varieties of potatoes tested on the Experimental Farm at Agassiz in 1906 was 353 bush. 53 lbs. per acre.

SUMMARY.

The results obtained from the uniform trial plots as given in this bulletin show that there are marked differences in the relative productiveness of varieties even when grown side by side under similar conditions. The results of the average crops obtained for five years indicate also that the tendency to productiveness is in many instances persistent, manifesting itself under varying conditions of soil and climate to a remarkable degree. The establishment of such facts points to the importance of farmers choosing for seed those varieties which give the heaviest crops, so that farming in Canada may thus be made more profitable.

During the past year the number of varieties under test has been further reduced by dropping some of those which have failed to come up to the high standard required. This reduction in the number tested will serve to give greater prominence to those varieties of the highest excellence.

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

BUSH FRUITS

WITH

LISTS OF VARIETIES FOUND MOST USEFUL

BY

W. T. MACOUN
Horticulturist of the Central Experimental Farm

BULLETIN No. 56

APRIL, 1907

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

S
133
E22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

BUSH FRUITS

WITH

LISTS OF VARIETIES FOUND MOST USEFUL

BY
W. T. MACOUN
Horticulturist of the Central Experimental Farm

BULLETIN No. 56

APRIL, 1907

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

To the Honourable the
Minister of Agriculture.

SIR,—I have the honour to submit for your approval the Fifty-sixth Bulletin of the Experimental Farm Series on Bush Fruits, which has been prepared at my request by Mr. W. T. Macoun, Horticulturist of the Central Experimental Farm.

The cultivation of small fruits has of late years engaged the attention of a large number of fruit growers and farmers in the different provinces of Canada, many of whom have found in this occupation a considerable source of profit. The fact that many of these useful fruits can be successfully grown in every settled district in the Dominion makes it important that practical information regarding the most approved methods of cultivation and the most profitable varieties to grow should be widely disseminated.

The information submitted by the Horticulturist in this bulletin contains the conclusions reached by him after long experience, and embodies the results of the tests and observations which have been carried on at the Central Experimental Farm for the past twenty years. By adopting the methods of cultivation, and selecting the varieties here recommended, anyone so desiring can, with very little labour, supply his household with delicious fruit during the summer months, when such an addition to the diet is most healthful and necessary.

I have the honour to be,

Your obedient servant,

WM. SAUNDERS,
Director.

OTTAWA, April 20, 1907.

BUSH FRUITS.

By W. T. Macoun,
Horticulturist of the Central Experimental Farm.

Many kinds of bush fruits succeed in Canada, either in the wild condition or under cultivation, but among those which are cultivated there are none more important than the currant, gooseberry, raspberry and blackberry. These fruits succeed admirably over a large part of Canada, and owing to their hardiness the currant and gooseberry especially, may be grown with success almost or quite to the Arctic circle. As settlement extends northward the bush fruits will be more and more appreciated by the people, as it becomes increasingly difficult to grow the tree fruits. All of the bush fruits mentioned produce good fruit even in the wild condition, but the improved varieties under cultivation give so much better results that everyone who can should grow them.

During the past twenty years much attention has been paid to the currant, gooseberry, raspberry and blackberry at the Central Experimental Farm. Many varieties of these fruits have been tested and experiments tried in methods of culture, spraying, &c. In the year 1895 a bulletin on raspberries (Bulletin 22), was published, giving the results of experiments up to that year, but the other fruits are now dealt with in bulletin form for the first time.

An important feature of this bulletin is the descriptions of 45 varieties of currants, gooseberries and raspberries, originated by Dr. Wm. Saunders, Director of the Dominion Experimental Farms. Most of these descriptions are published for the first time here.

We wish to acknowledge our indebtedness to Dr. James Fletcher, Dominion Entomologist, whose descriptions of the insects injurious to the fruits dealt with in this bulletin, with remedies for the same, make the bulletin much more valuable than it otherwise would be.

Thanks are also due Mr. Frank T. Shutt, Chemist of the Dominion Experimental Farms, for much work done in preparing the illustrations for this bulletin.

THE CURRANT.

The currant is not so generally used in Canada as some other fruits, as few persons care for them when eaten raw, and when cooked they are usually made into jelly and consumed by only a comparatively small proportion of the people. In the colder parts of Canada where other fruits do not succeed well the currant is more popular, and is used much more generally. It is a wholesome and refreshing fruit and deserves much more attention than it gets at the present time.

The cultivated varieties of the black currant are derived from *Ribes nigrum,* a native of northern Europe and Asia; the red and white varieties are from *Ribes rubrum,* a native of the northern parts of America, Europe and Asia.

The currant is not known to have been under cultivation before the middle of the sixteenth century. It is not mentioned by any of the ancient writers who wrote about fruit, and was evidently not known by the Romans.

The currant does not vary so much when grown from seed as most cultivated fruits, and being so easily propagated from cuttings it has not been improved so much as it otherwise would have been. Moreover, size in currants was not of great importance until recent years, when competition in marketing has become keener. It is only during the past fifty or sixty years that many new varieties were introduced. At the beginning of the nineteenth century few named sorts were recognized in England, the currant being generally known simply under the names black, red and white.

Being natives of the north, most varieties of currants succeed over a very wide territory in Canada, and for this reason they are among the best fruits for planting, and being easy of propagation and cultivation there is nothing to prevent anyone who has room enough for a few bushes from growing them for home use.

PROPAGATION.

The usual method of propagating currants is by means of cuttings. These root very readily and good plants are obtained after one season's growth. The best time to make the cuttings is in the autumn, as currants begin to grow very early in the spring, and once the buds have swollen they cannot be rooted successfully. Wood of the current season's growth is used. This may be cut early in the autumn as soon as the wood has ripened, at Ottawa from the end of August to the middle of September being a good time. They should be cut in as long pieces as possible to save time in the field, and put in a cool moist cellar or buried in sand. If the cuttings can be made at once it is best to do so. These are made by cutting the wood into pieces each about eight to ten inches long, although an inch or two more or less is not of much consequence. The base of the cutting should be made with a square cut just below the last bud. There should be at least half an inch of wood left above the top bud of each cutting, as there should be a strong growth from the upper bud, and if the wood is cut too close it is liable to be weakened. A sloping cut is best for the upper cut, as it will shed rain better, but this is not important. When made, the cuttings should be planted at once, which is usually the best plan, or heeled in. If heeled in they should be tied in bundles and buried upside down in warm, well-drained soil, with about three inches of soil over them. The object of burying them upside down is that by this method the bases of the cuttings will be nearer the surface where the soil is warmer and there is more air, and they will callus quicker than if they were further down. The cuttings should callus well in a few weeks, and they may then be planted outside if thought advisable. Cuttings may be kept in good condition over winter by heeling in or burying in sand in a cool cellar, or after callusing under a few inches of soil outside they may be left there over winter if covered with from four to five more inches of soil to prevent their drying out. Good results are obtained with the least trouble by plant-

ing the cuttings in nursery rows as soon as they are made. The soil should be well prepared and should be selected where water will not lie. Furrows are opened three feet apart and deep enough so that the top bud, or at most two buds, will be above ground. The cuttings are placed about six inches apart on the smooth side of the furrows and soil thrown in and tramped well about them. Where only a small number are to be planted a trench may be opened with a spade. It is important to have most of the cutting below ground, as more roots will be made and the plants will be stronger. There would also be danger of the cuttings drying up before rooting if too much of the wood is exposed. If the season is favourable the cuttings should callus well and even throw out a few roots by winter. Where there is little snow in winter it is a good practice to cover the tops of the cuttings with about two inches of soil, which will be a good protection for them. This soil should be raked off in spring. In the spring cultivation should be begun early and kept up regularly during the summer to conserve moisture and favour rooting and the development of the bushes. By autumn they should be large enough to transplant to the field.

In Great Britain and Europe currants are often grown in tree form, and are prevented from throwing up shoots from below ground by removing all the buds of the cuttings except the top one before planting in the nursery. This system is not recommended for this country as it has been found by experience that snow breaks down currants grown in this way, and where borers are troublesome it is not wise to depend on one main stem.

Most of the cultivated varieties of currants have originated as natural seedlings, little artificial crossing having been done with this fruit. Currants grow readily from seeds, and it is easy to get new varieties in this way. The seeds are washed out of the ripe fruit, and after drying, may either be sown at once or mixed with sand and kept over winter in a cool, dry place and sown very early in the spring. The best plan is to sow them in the autumn in mellow, well prepared and well drained soil, as if this is done they will germinate very early in the spring, while if sown in the spring the seed may be all summer without sprouting. The seed should not be sown deep, from one-quarter to one-half an inch being quite sufficient. If sown very deep they will not germinate. The young plants may be transplanted from the seed bed to the open in the autumn of the first year if large enough, but if the plants are very small they may be let grow another season, when they should be planted out at least four by five feet apart, so as to give them room enough to fruit for several seasons, in order that their relative merits may be learned. If intended to remain permanently the plants should be at least six by five feet apart. The bushes should begin to bear fruit the second or third year after planting out. Each bush will be a new variety, as cultivated fruits do not come true from seed. If a seedling is considered promising it may be propagated or increased by cuttings, as already described.

THE SOIL AND ITS PREPARATION.

Currants should be planted in rich soil in order to get the best results. The soil should also be cool as the currant is a moisture-loving bush. The currant roots near the surface, hence if the soil is hot and dry the crop will suffer. A rich, well-drained clay loam is the best for currants, although they do well in most soils. If the soil is not as good as it might be it should receive a good dressing of manure before planting, which should be well worked into the soil, the latter being thoroughly pulverized before planting is done. A northern exposure is to be preferred, as in such a situation the currants are not so likely to suffer in a dry time.

PLANTING.

The best time to plant currants is in the autumn. If planted in the spring they will probably have sprouted somewhat before planting, and on this account their growth the first season will be checked. Where the soil is in good condition, currants, especially the black varieties, make strong growth, and the bushes reach a large size, hence it is

best to give them plenty of space as they will do better and are easier picked than if crowded. Six by five feet is a good distance to plant. If planted closer, especially in good soil, the bushes become very crowded before it is time to renew the plantation. Strong one-year old plants are the best, but two-year old plants are better than poorly rooted yearlings. It is better to err on the side of planting a little deeper than is necessary than to plant too shallow. A good rule to follow is to set the plants at least an inch deeper than they were in the nursery. The soil should be well tramped about the young plant so that there will be no danger of it drying out. After planting, the soil should be levelled and the surface loosened to help retain moisture.

CULTIVATION.

As the currant, to do well, must have a good supply of moisture, cultivation should be begun soon after planting, and the surface soil kept loose during the summer. While the plants are young the cultivation may be fairly deep in the middle of the rows, but when the roots begin to extend across the rows, cultivation should be quite shallow, as many of the roots are quite near the surface.

FERTILIZERS.

After the first application of manure, no more should be necessary until the plants begin to fruit, unless other crops are grown between, when an annual top dressing of well-rotted barnyard manure is desirable. Where only a light application of manure is given, the addition of two or three hundred pounds per acre of muriate of potash should be very beneficial. Wood ashes also would make a good fertilizer with barnyard manure. There is little danger of giving the currant plantation too much fertilizer. Unfortunately, it is usually the other way, this fruit being often very much neglected.

PRUNING.

The black and red currants bear most of their fruit on wood of different ages, hence the pruning of one is a little different from the other. The black currant bears most of its fruit on wood of the previous season's growth, hence it is important to always have a plentiful supply of one-year old healthy wood; the red and white currants produce their fruit on spurs which develop from the wood two or more years of age, hence it is important in pruning red and white currants to have a liberal supply of wood two years and older, but as the fruit on the very old wood is not so good as that on the younger, it is best to depend largely on two and three year old wood to bear the fruit. A little pruning may be necessary at the end of the first season after planting in order to begin to get the bush into shape. From six to eight main stems, or even less, with their side branches will, when properly distributed, bear a good crop of fruit. Future pruning should be done with the aim of having from six to eight main branches each season and a few others coming on to take their places. By judicious annual pruning the bush can be kept sufficiently open to admit light and sunshine. A good rule is to not have any of the branches more than three years of age, as if kept down to this limit the wood will be healthier, stronger growth will be made and the fruit will be better.

WHEN TO RENEW THE PLANTATION.

A currant plantation will bear a great many good crops if well cared for, but if neglected the bushes lose their vigour in a few years. The grower will have to decide when to renew the plantation by the appearance of the bushes, but as a currant plantation can be renewed at comparatively little labour it is best to have new bushes coming on before the old ones show signs of weakness. At least six good crops may be removed with fair treatment, and ten or more can be obtained if the bushes are in rich soil and well cared for. Where one has only a few bushes for home use they may be re-

Cherry Currant. (Plate 1.)

invigorated by cutting them down to the ground in alternate years, and thus obtaining a fresh supply of vigorous young wood.

YIELD OF CURRANTS.

The red currant is one of the most regular in bearing of all fruits, and as it is naturally productive the average yield should be large. Bailey, in the Horticultural Rule Book, puts the average yield at 100 bushels per acre. Card, in his book on Bush Fruits, makes it 100 to 150 bushels, with a possible yield of 320 bushels per acre. At the Central Experimental Farm the Rankins Red, the largest yielder, averaged for the past four years at the rate of 8,107 lbs., or over 202 bushels per acre. The Red Dutch averaged at the rate of 7,335 lbs. per acre, or over 183 bushels. The largest yield from red currants obtained at the Central Experimental Farm was in 1900, when six bushes of the Red Dutch currant yielded 73 lbs. 15 ozs. of fruit. The bushes were 6 x 5 feet apart. This means a yield at the rate of 17,892 lbs. per acre, or at 40 lbs. per bushel, 447 bushels 12 lbs. per acre. The same variety in 1905, in a new plantation, yielded 55½ lbs. from six bushels, or at the rate of 13,431 lbs. per acre, or 335 bushels 31 lbs. These are very large yields, and while half of this amount may not be expected in ordinary field culture, the fact that such yields can be produced on a small area should be an inspiration to get more on a larger one.

The average yield of black currants has been somewhat less than the red, although individual yields have been large. The Saunders currant yielded for the past four years at the rate of 6,534 lbs. per acre, or over 163 bushels. The Kerry at the rate of 6,382 lbs. per acre, or over 159 bushels. The highest yield of black currants was obtained in 1905, when six bushes of Kerry planted 6 x 5 feet apart yielded 62 lbs. of fruit, or at the rate of 15,004 lbs. per acre, equal to 375 bushels, estimating at 40 lbs. to the bushel.

RED AND WHITE CURRANTS.

The red currant makes excellent jelly, and its popularity is largely due to this fact. A large quantity of red currant jelly is made every year in Canada. Red currants are used to a less extent for pies and as jam and are also eaten raw with sugar. As a fruit for eating out of hand the red currant is not very popular, but there are few fruits so refreshing and if it had less acidity more red currants would be eaten that way. The white currants are better liked for eating off the bush than the red as they are not so acid. The Moore Ruby and the Early Scarlet are two red varieties, however, which are milder than most others, and for this reason are better adapted for eating raw than most. The red currant does not vary as much in quality as the black.

Red currants will remain in condition on the bushes for some time after ripening, hence do not have to be picked so promptly as the black.

VARIETIES.

Following are the average yields of red and white currants at the Central Experimental Farm for the past four years. These yields indicate fairly well the relative productiveness of the different varieties here. The Wilder currant, which comes low on the list, although one of the best varieties for most districts, has had the fruit buds injured by winter here nearly every year of late. The Versaillaise, De La Rochepoze, Fertile d'Angers, Fay, Cherry, Admirable, Comet, Defiance, Redpath Ruby and Moore Ruby have also suffered in this respect and are distinctly more tender than other sorts. The Prince Albert currant, a good late variety, is not in the following table, as the bushes supposed to be this variety turned out to be not true to name.

There are in the currant plantation at the Central Experimental Farm 44 red and 15 white varieties, a total of 59 sorts.

RED AND WHITE CURRANTS.

AVERAGE YIELD OF VARIETIES—FOUR YEARS.

Average Rank.	Number of years averaged.	Rank 1906.	Name.	Date ripe.	Total yield 1906.		Average total yield.	
					lbs.	oz.	lbs.	oz.
1	4	1	Rankins Red	July 13	45	8	33	8
2	4	8	Cumberland Red	" 14	35	0	33	4
3	4	14	Red Dutch	" 15	25	8	30	5
4	4	5	Large Red	" 14	36	8	29	14
5	2	11	Franco German	" 22	29	12	29	14
6	4	4	Simcoe King	" 14	40	8	29	12
7	4	12	Red English	" 13	28	8	29	0
8	4	16	Long Bunched Holland	" 13	25	0	27	8
9	4	2	Victoria Red	" 12	42	8	26	10
10	4	23	New Red Dutch	" 13	20	0	26	8
11	4	18	North Star	" 13	23	0	26	8
12	4	10	Moore Seedling	" 13	30	8	26	2
13	4	9	Ribes Striatum	" 22	33	8	26	2
14	4	22	Pomona	" 13	20	0	26	0
15	4	13	Goliath	" 13	26	8	25	6
16	4	6	Raby Castle	" 13	35	8	25	5
17	4	3	Knight Large	" 13	40	8	25	2
18	4	7	London Red	" 15	35	8	24	6
19	4	17	La Hative	" 14	24	0	23	6
20	4	20	Red Grape	" 13	22	0	22	9
21	4	21	Greenfield	" 13	21	8	21	14
22	4	15	La Conde	" 13	25	8	21	6
23	4	19	Benwell	" 13	23	0	17	13
24	4	24	Houghton Castle	" 13	17	8	14	4
25	4	25	Wentworth Seedling	" 13	16	0	12	14
26	4	28	Champion Red	" 16	10	0	12	13
27	4	30	Wilder	" 13	6	0	11	11
28	4	29	Early Scarlet	" 12	6	8	11	0
29	4	26	Ringens	" 17	15	0	10	2
30	4	31	Versaillaise	" 15	4	0	9	6
31	4	27	De la Rochepoze	" 22	12	8	9	2
32	4	32	Fertile d'Angers	" 13	4	0	9	0
33	4	35	Fay	" 13	3	0	8	2
34	4	36	Cherry	" 13	2	8	7	8
35	2	..	Admirable	" —	–	–	6	10
36	3	..	Comet	" —	–	–	6	0
37	3	33	Defiance	" 14	3	8	4	13
38	3	37	Redpath Ruby	" 17	2	8	4	10
39	4	34	Moore Ruby	" 13	3	8	4	7
			White Currants.					
1	4	1	White Cherry	July 10	32	0	27	0
2	4	3	Large White	" 10	24	0	23	4
3	4	6	Climax White	" 13	16	8	18	2
4	4	14	White Grape	" 14	7	0	17	9
5	4	15	Verrieres White	" 14	5	8	17	7
6	4	2	White Imperial	" 14	29	6	16	13
7	4	5	White Dutch	" 13	18	0	16	9
8	4	13	Eyatt Nova	" 14	8	0	16	7
9	4	7	Large White Brandenburg	" 10	16	0	15	12
10	4	8	White Kaiser	" 13	15	0	14	10
11	4	4	Champagne White	" 13	23	8	13	14
12	4	12	Wentworth Leviathan	" 13	10	0	12	13½
13	4	11	White Pearl	" 14	10	8	11	15
14	4	9	Gondouin White	" 16	14	0	9	4
15	4	10	White Transparent	" 14	12	8	8	1

VARIETIES OF RED AND WHITE CURRANTS RECOMMENDED.

Red.—For general culture.—Pomona, Victoria, Cumberland Red, Red Dutch, Greenfield, Rankins Red, Red Grape.

Where bushes are protected with snow in winter, and for the milder districts: Pomona, Victoria, Cumberland Red, Wilder, Cherry, Fay and Red Cross.

White.—White Cherry, Large White, White Grape.

It is possible that under different conditions of soil and climate other varieties might do equally well.

Descriptions of Varieties.

The following descriptions were made from fruit grown at the Central Experimental Farm, Ottawa, and represent a compilation of notes on these varieties made during the time they have been fruiting. It is quite likely that the names of some of these currants are synonyms (the same variety under different names), but as the varieties of currants differ from one another less than most other fruits it would be very difficult to separate the synonyms with certainty. The Raby Castle and Houghton Castle, for instance, are both said to be synonyms of the Victoria, but as grown here they have not proved so productive, hence have been referred to as if distinct.

RED VARIETIES.

Admirable.—A medium grower; unproductive here. Resembles Fay. Bush breaks easily.

Benwell.—A medium, rather spreading grower; moderately productive. Fruit small in medium bunches about two-thirds filled; bright scarlet; very acid; medium quality. Season Medium. Not desirable.

Champagne Red.—A medium grower; unproductive. Fruit uneven in size, small to above medium, in bunches of medium length about three-fourths filled; bright scarlet; acid; medium in quality. Season medium late. Resembles the variety named Ringens. Not promising.

Cherry.—Probably originated in Italy. Introduced from there into France and fruited in 1843; subsequently brought to America. A medium grower; unproductive at Ottawa, but productive in milder districts. Fruit large to very large in long, well filled bunches; deep scarlet; acid; medium quality. Season medium. See Plate 1.

Chenonceaux.—A medium grower; unproductive here. Fruit large to very large; scarlet; acid; medium quality. Season medium. Resembles Versaillaise.

Comet.—This variety resembles Versaillaise and is believed to be the same. Has proved unproductive here.

Cumberland Red.—A strong, moderately spreading grower; very productive; fruit of medium size in bunches of medium length, averaging only about half filled; bright scarlet; acid; medium quality. Season medium. This is one of the most productive currants.

Defiance.—A medium grower, resembling the Fay. Unproductive here.

De La Rochepoze.—A very strong, upright grower; unproductive. Fruit of medium size in medium to long bunches, about one-half filled; pale yellow suffused with red; very acid; quality below medium. Season late. Not desirable.

Early Scarlet.—Originated by Dr. Wm. Saunders. A medium grower, not very productive. Fruit of medium size in bunches of medium length, about two-thirds filled; pleasantly acid, milder than most; of good quality. Season early. This is the earliest variety tested. This and Moore's Ruby are the best to eat out of hand.

Fay.—Originated in 1868 with Lincoln Fay, Chatauqua Co., N.Y., and introduced about 1883. Probably a seedling of Cherry. A medium, spreading grower, unproductive at Ottawa, but a moderate bearer in some places. Fruit large to very large in long,

well filled bunches; deep scarlet; acid; quality medium to above medium. Season medium. Fruit buds too tender at Ottawa. Bushes also break down easily. Not desirable in the north.

Fertile d'Angers.—Resembles Versaillaise, of which it is said to be a synonym.

Franco-German.—A very strong, upright grower; productive. Fruit medium to above medium in size, mostly above medium, in long, well filled bunches; rather pale scarlet; acid; medium quality; season late. Quite distinct from most varieties in foliage and habit of bush. Resembles Prince Albert somewhat. A promising late sort.

Goliath.—A strong, moderately upright grower, productive. Fruit of medium size, in bunches of medium length, about three-fourths filled; bright scarlet; acid; medium quality. Season medium. Said to be a synonym of Victoria, but fruit does not average as large as that variety here.

Greenfield.—Originated by S. Greenfield, Ottawa East, Ont.— A strong, moderately spreading grower; productive. Fruit medium to above medium in size in well filled bunches; bright scarlet; pleasantly acid; quality above medium; season medium. This variety averages well in size and is a good cropper, although not as productive as some others.

Houghton Castle.—A moderately vigorous, spreading grower; moderately productive. Fruit of medium size in well filled bunches of medium length; bright scarlet; acid; medium in quality. Season medium. Not sufficiently productive. Said to be the same as Raby Castle and Victoria.

La Conde.—A strong, moderately spreading grower; fairly productive. Fruit medium to above medium in size in medium, well filled bunches; bright scarlet; acid; medium in quality. Has distinct foliage. Not desirable.

La Fertile.—A poor grower; unproductive here; has not fruited enough to judge of its merits.

La Hative.—A strong, spreading grower; productive. Fruit small, in long, well filled bunches; bright scarlet. Season medium. Too small. Not desirable.

Large Red.—A strong, spreading grower. One of the most productive. Fruit small to medium, mostly medium, in medium to long, well filled bunches; bright scarlet; acid; of medium quality. Season medium. Not large enough.

London Red.—An upright, medium grower; productive. Fruit above medium to large in bunches under medium length and about one-half filled; bright scarlet; acid; medium quality. Season medium. Resembles Red Grape. Not sufficiently productive.

Long Bunched Holland.—A very strong, moderately upright grower; productive. Fruit small to medium, mostly medium, in very long, well filled bunches; bright scarlet; very acid; medium quality. Season medium to late. One of the strongest growing varieties, but the fruit is not quite large enough and is also too acid.

Moore Ruby.—Originated by Jacob Moore, Attica, N.Y. A seedling of Cherry, supposed to have been pollenized by White Grape. A medium grower, not productive here, as most of the fruit buds are killed. Moderately productive elsewhere. Fruit above medium to large in bunches of medium length; bright scarlet; briskly subacid of pleasant flavour; good quality. Season medium. The best for eating out of hand.

Moore Seedling.—A strong, upright grower; productive. Fruit above medium to large in well filled bunches of medium length; bright scarlet; pleasantly acid; quality above medium. Season medium. A good currant resembling Red Grape.

New Red Dutch.—A medium, fairly upright grower; productive. Fruit medium to large in long, well filled bunches; bright scarlet; pleasantly acid; quality above medium. Season medium. A good variety. Said by some to be the same as Red Dutch, but is a larger currant as grown here.

North Star.—Introduced by the Jewell Nursery Co., Lake City, Minn. A chance seedling. A strong, upright grower; productive. Fruit small to medium in medium

sized bunches about half filled: bright scarlet; acid; of medium quality. Season medium. A productive variety, but not large enough to be desirable.

Perfection.—Originated by Charles G. Hooker, Rochester, N.Y. A cross between Fay and White Grape. This variety is being grown at Ottawa but has not been tested long enough to judge of its relative merits. It has long fruit clusters and the fruit is large. It is a promising variety.

Pomona.—Introduced by Albertson & Hobbs, Bridgeport, Ind. A medium, rather spreading grower; productive. Fruit medium to large, in long, well filled bunches; bright scarlet; acid; of medium quality. Season medium. This is a desirable variety, the fruit averaging a good size.

Prince Albert.—A strong, upright grower; moderately productive. Fruit above medium size, in long, well filled bunches; bright, rather pale scarlet; acid; of medium quality. Season late. A good variety for lengthening the season.

Raby Castle.—A strong, moderately spreading grower; productive. Fruit small to medium, in medium to long, well filled bunches; bright scarlet; acid; of medium quality. Season medium. A well known variety. Much like Victoria, but smaller as grown here. Said to be the same as Victoria.

Rankins Red.—A strong, upright grower. The most productive variety tried here during the past four years. Fruit small to medium, mostly medium, in medium to long, well filled bunches; bright scarlet; acid; of medium quality; season medium. A good variety, although fruit is not large.

Red Cross.—Originated with Jacob Moore, Attica, N.Y. A cross between Cherry and White Grape. This variety was omitted in the plantation at Ottawa. The following description was made by A. W. Peart, Burlington, Ont., Small Fruit Experimenter: Bush spreading, moderately vigorous, hardy and productive; leaves light green; bunch short and compact; berry red, medium to large $\frac{3}{8}$ to $\frac{1}{2}$ inch, firm, sprightly subacid. Season medium. Yield 4 lbs.

Red Dutch.—A strong, moderately spreading grower; very productive. Fruit small to medium in long, well filled bunches; bright scarlet; acid; medium in quality. Season medium. One of the most productive, hence where mere quantity is desired, one of the best.

Red English.—A strong, upright grower; productive. Fruit medium to above medium, in bunches of medium length and well filled; bright scarlet; acid; medium in quality. Season medium. A promising variety.

Red Grape.—A strong, upright grower; productive. Fruit medium to large, in bunches of medium length, usually not more than half filled; scarlet; acid; quality above medium. Season medium. Much like London Red.

Redpath Ruby.—A medium grower. Fruit medium to large; scarlet; acid; quality above medium. Not in bearing long enough to make fair comparison with others. Promising.

Ribes Striatum.—A very strong, upright grower; productive. Fruit of medium size in medium to long bunches, about one-half filled; yellow, striped and suffused with red; very acid; quality below medium. Season late. Not desirable.

Ringens.—A medium grower, quite spreading; unproductive. Fruit medium to above medium size in long, well filled bunches; scarlet, paler than most; pleasantly acid; quality above medium. Season late. This is decidedly later than most varieties.

Simcoe King.—An upright, medium grower; productive. Fruit above medium to large in medium sized bunches, only about one-half filled; bright to rather pale scarlet; acid. Quality above medium. Season medium. Very similar to Red Grape in appearance.

Versaillaise.—Originated by M. Bertin, Versailles, France, from seed of the Cherry. A moderately vigorous grower; not productive at Ottawa. Fruit large to very large in long bunches, usually about two-thirds filled; deep scarlet; acid; quality medium;

season medium. Fruit buds too tender at Ottawa, where it has proved very similar to Cherry. A light cropper.

Victoria.—A strong, moderately upright grower; productive. Fruit medium to almost large, in medium to long, well filled bunches; bright scarlet; medium in quality; season medium. This is one of the best currants, being hardy, productive and the fruit averaging a good size.

Wentworth Seedling.—A medium, moderately spreading grower; unproductive. Fruit of medium size in bunches of medium length, about half filled; colour bright scarlet; pleasantly acid; quality above medium. Season medium. Quality better than most. Resembles La Conde, but not so productive.

Wilder.—Originated with E. Y. Teas, Irvington, Ind. A seedling of Versaillaise. A medium to strong upright grower; very productive in some places, and in some years at Ottawa, but is tender in fruit bud, and hence the crop is uncertain. Fruit large in long, well filled bunches; bright scarlet; pleasantly acid; quality above medium. Season medium. One of the best varieties in the milder districts.

WHITE CURRANTS.

Champagne White.—A strong, upright grower. Fruit medium to large, moderately productive in medium to long bunches about half filled; pale yellow; sub-acid, of pleasant flavour and good quality. Season medium. This is a good variety.

Climax White.—Originated by Dr. Wm. Saunders. A strong, upright grower; productive. Fruit medium to large in medium sized bunches about one-half filled; pale yellow; briskly subacid; quality good, better than most. Season medium.

Eyatt Nova.—A medium, upright grower; moderately productive. Fruit above medium to large in long, well filled bunches; pale yellow; acid; medium in quality. Season medium. One of the best looking white varieties.

Large White.—A strong, upright grower; productive. Fruit medium to large, in medium to long bunches, only about half filled; pale yellow; briskly subacid; quality above medium, better than most. Season early. One of the best.

Large White Brandenburg.—A moderately upright, medium grower; fairly productive. Fruit above medium to large in size, in long bunches, usually about half filled; yellow; briskly subacid, with a pleasant flavour; quality above medium. Season early. This is one of the largest white varieties.

Verrieres White.—A strong, upright grower; moderately productive. Fruit medium to above medium in size in medium to long, well filled clusters; pale yellow; briskly subacid; quality above medium. Not of special merit.

White Cherry.—A strong, upright grower; the most productive white currant tested here. Fruit above medium size in well filled bunches of medium length; pale yellow; acid; of medium quality. Season early.

Wentworth Leviathan.—A strong, moderately spreading grower; rather unproductive. Fruit small to medium in size in medium bunches about two-thirds filled; pale yellow; briskly sub-acid; with a pleasant flavour; good quality. Season medium.

White Dutch.—A medium grower; moderately productive. Fruit uneven, small to large in large, well filled bunches; yellowish white; pleasantly acid. Season medium.

White Gondouin.—A strong, upright grower; unproductive here, but reported productive elsewhere. Fruit small to medium in medium bunches only one-half to one-third filled; yellowish; briskly sub-acid; quality above medium: better in quality than most white varieties. Season medium.

White Grape.—A strong, moderately spreading grower; productive. Fruit medium to above medium in size, in bunches of medium length, about half filled; pale yellow; sub-acid, of pleasant flavour and good quality. Season medium. One of the most reliable white currants.

season medium. Fruit buds too tender at Ottawa, where it has proved very similar to Cherry. A light cropper.

Victoria.—A strong, moderately upright grower; productive. Fruit medium to almost large, in medium to long, well filled bunches; bright scarlet; medium in quality; season medium. This is one of the best currants, being hardy, productive and the fruit averaging a good size.

Wentworth Seedling.—A medium, moderately spreading grower; unproductive. Fruit of medium size in bunches of medium length, about half filled; colour bright scarlet; pleasantly acid; quality above medium. Season medium. Quality better than most. Resembles La Conde, but not so productive.

Wilder.—Originated with E. Y. Teas, Irvington, Ind. A seedling of Versaillaise. A medium to strong upright grower; very productive in some places, and in some years at Ottawa, but is tender in fruit bud, and hence the crop is uncertain. Fruit large in long, well filled bunches; bright scarlet; pleasantly acid; quality above medium. Season medium. One of the best varieties in the milder districts.

WHITE CURRANTS.

Champagne White.—A strong, upright grower. Fruit medium to large, moderately productive in medium to long bunches about half filled; pale yellow; sub-acid, of pleasant flavour and good quality. Season medium. This is a good variety.

Climax White.—Originated by Dr. Wm. Saunders. A strong, upright grower; productive. Fruit medium to large in medium sized bunches about one-half filled; pale yellow; briskly subacid; quality good, better than most. Season medium.

Eyatt Nova.—A medium, upright grower; moderately productive. Fruit above medium to large in long, well filled bunches; pale yellow; acid; medium in quality. Season medium. One of the best looking white varieties.

Large White.—A strong, upright grower; productive. Fruit medium to large, in medium to long bunches, only about half filled; pale yellow; briskly subacid; quality above medium, better than most. Season early. One of the best.

Large White Brandenburg.—A moderately upright, medium grower; fairly productive. Fruit above medium to large in size, in long bunches, usually about half filled; yellow; briskly subacid, with a pleasant flavour; quality above medium. Season early. This is one of the largest white varieties.

Verrieres White.—A strong, upright grower; moderately productive. Fruit medium to above medium in size in medium to long, well filled clusters; pale yellow; briskly subacid; quality above medium. Not of special merit.

White Cherry.—A strong, upright grower; the most productive white currant tested here. Fruit above medium size in well filled bunches of medium length; pale yellow; acid; of medium quality. Season early.

Wentworth Leviathan.—A strong, moderately spreading grower; rather unproductive. Fruit small to medium in size in medium bunches about two-thirds filled; pale yellow; briskly sub-acid; with a pleasant flavour; good quality. Season medium.

White Dutch.—A medium grower; moderately productive. Fruit uneven, small to large in large, well filled bunches; yellowish white; pleasantly acid. Season medium.

White Gondouin.—A strong, upright grower; unproductive here, but reported productive elsewhere. Fruit small to medium in medium bunches only one-half to one-third filled; yellowish; briskly sub-acid; quality above medium; better in quality than most white varieties. Season medium.

White Grape.—A strong, moderately spreading grower; productive. Fruit medium to above medium in size, in bunches of medium length, about half filled; pale yellow; sub-acid, of pleasant flavour and good quality. Season medium. One of the most reliable white currants.

White Imperial.—A spreading, medium grower; moderately productive. Fruit above medium to large, in medium sized well filled bunches; pale yellow; mild; quality good. Fruit averages larger than some others.

White Kaiser.—A strong, upright grower; not very productive. Fruit medium to large in medium to large bunches, about three-fourths filled; pale yellow; sub-acid, of a pleasant flavour; good quality. Season medium. Better in quality than most.

White Pearl.—A medium grower, moderately upright; unproductive. Fruit large in size and in large, well filled bunches; pale yellow; briskly subacid; quality above medium. Season medium. This is one of the largest fruited varieties.

White Transparent.—A spreading, medium grower; unproductive. Fruit medium to large size in well filled bunches of medium length; pale yellow; briskly sub-acid; quality medium. Season medium. Not sufficiently productive.

CRANDALL CURRANT.

Crandall.—This is a variety of the Buffalo or Missouri currant *(Ribes aureum)*. A tall, strong, moderately upright grower; moderately productive. Fruit varies in size from small to large in small, close bunches; bluish black, skin thick; sub-acid with a peculiar flavour. Quality medium. Ripens very unevenly. Season late July to September. As this variety ripens after the others the birds concentrate on it and get a large proportion of the fruit.

BLACK CURRANTS.

There are not so many black currants grown in Canada as red, but there is a steady demand for them, and it is believed there will be an increasing demand as they become better appreciated. The black currant makes excellent jelly and the merits of black currant jam have long been known.

Black currants vary considerably in season, yield and quality, hence it is important to know those which are the best, and in the following table the average yields obtained at the Central Experimental Farm for four years are given, followed by descriptions of the varieties, so that those who desire to plant may know which are the best. As most varieties of black currants drop badly from the bushes as soon as ripe it is important to pick them in good time. Most of the cultivated varieties have been derived from the European species *Ribes nigrum,* although the native black currant *Ribes floridum,* is edible and may be improved.

BLACK CURRANTS—YIELDS OF VARIETIES.

AVERAGE OF FOUR YEARS.

Average Rank.	Number of years averaged.	Rank 1906.	Name.	Date ripe.	Total yield, 1906.		Average total yield.	
					lbs.	oz.	lbs.	oz.
1	4	11	Ogden	July 17	15	–	31	6
2	4	5	Saunders	" 13	18	–	27	–
3	4	6	Kerry	" 13	18	–	26	6
4	4	9	Ontario	" 13	15	8	25	7
5	4	10	Eagle	" 13	15	–	23	14
6	4	1	Clipper	" 12	27	–	20	12
7	4	22	Eclipse	" 10	9	–	20	10
8	4	4	Collins Prolific	" 20	18	8	20	7
9	4	13	Climax	" 16	13	–	19	3
10	4	2	Merveille de la Gironde	" 17	19	8	19	–
11	4	17	Ethel	" 13	10	8	18	11
12	4	25	Magnus	" 13	8	–	18	4
13	4	32	Success	" 11	5	–	16	6
14	4	30	Norton	" 14	7	–	16	2
15	4	20	Bang Up	" 13	10	–	16	2
16	4	19	Kentish Hero	" 17	10	–	15	14
17	4	15	Grape	" 13	11	6	15	13
18	4	29	Buddenborg	" 20	7	–	15	4
19	4	3	Prince of Wales	" 20	18	8	15	3
20	4	14	English	" 14	12	8	14	14
21	4	8	Baldwin	" 20	16	8	14	10
22	3	27	Lee Prolific	" 13	8	–	13	15
23	4	16	Beauty	" 17	10	8	13	14
24	4	12	Topsy	" 13	14	–	13	6
25	4	28	Gewohnliche	" 13	7	8	13	–
26	4	33	Winona	" 10	3	0	12	15
27	4	18	Standard	" 13	10	8	12	9
28	4	7	Prince	" 21	17	8	12	7
29	4	26	Orton	" 13	8	–	10	15
30	4	31	Champion	" 20	6	8	10	14
31	4	21	Victoria	" 17	9	–	10	4
32	4	24	Ismay Prolific	" 20	8	8	10	2
33	4	23	Naples	" 20	9	–	9	10

There are 33 named varieties of black currants growing at the Central Experimental Farm, of which 17 were originated by Dr. Wm. Saunders, the Director. The following descriptions have been made from the fruit as grown here. Information regarding the origin of some of the varieties was obtained from 'Bush Fruits,' by F. W. Card, and from other sources.

Baldwin.—A strong grower, but only moderately productive. Fruit small to medium in large bunches; skin moderately thick; briskly subacid; above medium in quality. Ripens somewhat unevenly. Season late. Not desirable.

Bang Up.—A strong grower, moderately productive. Fruit above medium to large, in medium bunches; skin moderately thick; briskly subacid; medium to above medium in quality. Ripens evenly. Season medium. One of the best English varieties. Said by some to be the same as English, but is different as grown here.

Buddenborg.—A strong grower; moderately productive. Fruit large to very large in medium bunches; skin rather thick; subacid; good flavour, good quality. Ripens fairly evenly. Season late. This is one of the largest fruiting varieties and one of the best in quality. More productive than Victoria Black.

Champion.—A medium grower; unproductive. Fruit medium to large in size, but in small clusters; skin thick; subacid, of good flavour; quality above medium. Ripens unevenly. Season late. Not desirable.

Climax Black Currant. (Plate 2)

Collins Prolific.—This is a Canadian variety. A strong grower and productive. Fruit mostly large and in large bunches; skin thick; acid; medium in quality. Ripens rather unevenly. Season late. One of the best commercial varieties on the market, although Saunders, Kerry, Eclipse and Clipper are better.

English.—A medium grower and only moderately productive. Fruit medium to above medium size in medium to large bunches. Skin rather thick and tough; subacid, of good flavour and good quality. Ripens unevenly. Season medium. Not sufficiently productive.

Gewohnliche.—A medium to strong grower, only moderately productive. Fruit small to medium in size, in small to medium bunches; skin medium; briskly subacid; of medium quality. Ripens rather unevenly. Season medium. Not desirable.

Grape.—A strong, spreading grower; moderately productive. Fruit medium to above medium size in medium bunches; skin moderately thick; briskly subacid; above medium in quality. Ripens evenly. Season medium. Not sufficiently productive.

Ismay Prolific.—A medium grower; unproductive. Fruit medium to above medium in size in small bunches; skin thick; briskly subacid; above medium in quality. Season late. Not desirable.

Kentish Hero.—A medium, spreading grower; moderately productive. Fruit uneven in size, medium to large in medium bunches; skin moderately thick; acid; medium quality. Ripens unevenly. Season medium to late. Not desirable.

Lee Prolific.—A strong grower; moderately productive. Fruit medium to large; skin rather thick; briskly subacid; above medium in quality. Season medium. Not nearly so productive as Saunders and Kerry.

Merveille de la Gironde.—A very strong grower and productive. Fruit below medium to medium in size, in medium to large bunches; skin moderately thick, tender; briskly subacid, good flavour; good quality. Ripens evenly. Season medium to late. One of the best in quality, but rather small.

Naples.—A medium grower; unproductive. Fruit of medium size in small bunches; skin thick; briskly subacid; medium to above medium in quality. Season late. Not sufficiently productive.

Ogden.—Bush a medium to strong grower, and the most productive black currant tested. Bunches medium to small. Fruit uneven in size, below medium to above medium; skin moderately thick, fairly tender; briskly subacid; quality medium. Ripens unevenly. Season medium to late. Great productiveness is its chief merit.

Prince.—A medium to strong grower; unproductive. Fruit medium to large, in small bunches; briskly subacid; above medium in quality. Season late. Not sufficiently productive.

Victoria.—Originated in England. A moderately strong grower and moderately productive. Fruit large to very large in medium bunches; skin thick; subacid, good flavour; good quality. Ripens somewhat unevenly. Season medium to late. One of the best English varieties and one of the largest currants.

Wales (Prince of Wales).—A medium to strong grower and moderately productive. Fruit medium to large, in small bunches; briskly subacid, good flavour; good quality. Ripens rather unevenly. Season late. Not as good as Collins Prolific, which is about the same season.

New Black Currants.

In 1887, When Dr. Wm. Saunders, Director of the Dominion Experimental Farms, moved to Ottawa from London, Ont., he brought with him from his garden in London about 150 seedling black currants. These had been raised by Dr. Saunders from an extra fine seedling of a Black Naples seedling obtained by him from a former lot of seedlings grown in 1879. There are still growing at the Central Experimental Farm

28 of the best of those brought from London, and a few others originated at Ottawa. After eighteen years' experience with these currants, it is possible to form a good estimate of their relative value with other kinds now on the market. The following sixteen varieties, which are given in order of productiveness, are practically all considered equal to any other named variety yet tested at Ottawa, and most of them are superior:—

Saunders.—Bush a strong grower and very productive. Bunches of medium size. Fruit above medium to large; skin thick; briskly subacid; quality medium. Season medium. One of the most promising commercial varieties. This is already offered for sale in Canada.

Kerry.—Bush a strong grower and very productive. Bunches medium to large. Fruit above medium to large; skin thick but tender; briskly subacid; quality above medium to good. Season medium to late. One of the most promising for commercial purposes on account of its great productiveness and good size of fruit.

Ontario.—Bush a strong grower and very productive. Bunches of medium size. Fruit medium to above medium in size; skin moderately thick, tender; briskly subacid; quality medium to good. Ripens evenly. Season medium. Promising on account of productiveness.

Eagle.—A strong grower and productive. Fruit medium to large, mostly large, in medium bunches; skin moderately thick; briskly subacid; medium quality. Ripens somewhat unevenly. Season medium. Although this is a productive variety it is not as good in quality as some others.

Clipper.—Bush a strong grower and productive. Bunches large. Fruit medium to large; skin moderately thick, tender; briskly subacid and of good flavour. Quality good. Fruit ripens somewhat unevenly. Season medium to late. Promising.

Eclipse.—Bush a medium to strong grower and productive. Bunches large. Fruit medium to large; skin moderately thick, fairly tender; subacid; quality good; ripens evenly. Season early. Promising on account of productiveness, size and quality.

Climax.—Bush a strong grower and productive. Bunches large. Fruit above medium to large. Skin moderately thick, fairly tender; briskly subacid, of good flavour; quality good. Season medium to late. One of the most promising. See Plate 2.

Ethel.—Bush a strong grower and productive. Bunches large. Fruit above medium size; skin rather thick; briskly subacid. Quality above medium. Fruit ripens evenly. Season medium. Promising on account of productiveness and size of fruit.

Magnus.—Bush a strong grower and very productive. Clusters medium in size. Fruit large; skin rather thick; subacid, of good flavour; quality good. Season medium. Promising on account of productiveness, size of fruit and quality.

Success.—Bush a medium grower, but productive. Bunches of medium size. Fruit large; skin moderately thick, tender; subacid, of good flavour; quality good to very good. Ripens evenly. Season very early. Promising on account of earliness, size of fruit and quality.

Norton.—A strong, rather spreading grower, moderately productive. Fruit below medium to medium in size; skin rather thick; briskly subacid, of good flavour; good quality. Ripens rather unevenly. Season medium.

Beauty.—A medium grower, moderately productive. Fruit medium to above medium in size, in medium bunches; skin medium; briskly subacid; medium quality. Ripens rather unevenly. Season medium to late.

Topsy.—Bush a strong grower, moderately productive. Bunches large. Fruit above medium to large; clings well; skin rather thick; briskly subacid; good flavour; quality good to very good. Season medium. Ripens evenly. This originated as a hybrid between Dempsey's Black Currant and a cross-bred gooseberry (Houghton X. Broom Girl). From this cross five plants grew. Of these, four had gooseberry foliage and one, the Topsy, black currant foliage and fruit.

Winona.—Bush a medium grower, productive. Bunches small to medium. Fruit above medium to large; subacid; quality good. Ripens evenly. Season early.

Standard.—A medium to strong grower, formerly productive but rather unproductive of late. Fruit above medium to large, in small bunches; skin medium; subacid, of pleasant flavour, and good quality. Ripens evenly. Season medium. Not as productive as some, but of good size and quality.

Orton.—A medium grower and rather unproductive. Fruit large to very large, in medium bunches; skin thick; subacid, good flavour; good quality. Ripens evenly. Season medium. Retained on account of size and quality, but not productive enough for a commercial currant.

Varieties of Black Currants Recommended.

Saunders, Collins Prolific, Buddenborg's, Victoria.

Of those not yet on the market which are considered equal or better than those above, the following are the best:—

Kerry, Eclipse, Magnus, Clipper, Climax and Eagle, and the Success for an early variety where yield is not so important as size and quality.

Topsy is very handsome and of good size and good quality, and ripens evenly, but has not been quite as productive as some others.

DISEASES OF THE CURRANT.

The currant is affected by very few diseases. The only ones which do much injury are the following:—

LEAF SPOT—RUST (*Septoria ribis,* Desm.).—The Leaf Spot fungus affects black, red and white currants, causing the leaves to fall prematurely, and thus weakening the bushes. This disease is first noticed about midsummer, when small brownish spots appear on the leaves. These often become so numerous that they affect a large part of the foliage, soon causing the leaves to fall. As the disease often appears before the fruit is picked it is difficult to control it if the bushes are not sprayed until after the fruit is picked. By using the ammoniacal copper carbonate the bushes may be sprayed a week or two before it is expected, without discolouring the fruit, giving a second application, if necessary. As soon as the fruit is picked the bushes should be thoroughly sprayed with Bordeaux mixture. Experiments have shown that this disease can be controlled by spraying.

CURRANT ANTHRACNOSE *(Glœosporium ribis).*—This disease, which may be mistaken for the Leaf Spot, affects different parts of the bush, including the leaves, leaf stalks, young branches, fruit and fruit stalks. On the leaves it is made evident during the month of June by the small brown spots which are usually smaller than those made by the Leaf Spot fungus. The lower leaves are affected first, and finally the upper ones. They turn yellow and gradually fall to the ground, and when the disease is bad the bushes are defoliated before their time. On the petioles or leaf stalks the disease causes slightly sunken spots. The fruit is affected with roundish black spots which are easier seen when the fruit is green. On the young wood the diseased areas are light in colour and are not so noticeable. The wood is not nearly so much injured by the disease as the leaves. The spores which spread this disease are formed in pustules, the majority of which are under the upper epidermis of the leaf. Where the spores are to appear the surface of the leaf is raised and blackened in spots looking like small pimples. When the spores are ready to come out the skin breaks and they escape and re-infect other parts. When the foliage drops early on account of this disease the fruit is liable to be scalded by the sun. The fruit may also wither before ripening properly owing to lack of food or of moisture, as the leaves having fallen they are unable to keep up the

necessary supply. The premature falling of the leaves prevents the buds from maturing properly, hence they are not in as good condition to bear fruit the next year.

Spraying with Bordeaux mixture is recommended as an aid in controlling this disease. It would be wise, where currant anthracnose is troublesome, to spray the bushes thoroughly before the leaves appear. A second spraying should be made when the leaves are unfolding, and successive sprayings at intervals of from ten to fourteen days until the fruit is nearly full grown, and there is danger of its being discoloured by the spray when ripe. Paris green should be added to the mixture when the first brood of the currant worm appears. A thorough spraying after the fruit is harvested is desirable.

THE GOOSEBERRY.

The gooseberry has received comparatively little attention in America, although in north Europe, and especially in the British Isles it has long been a prime favourite and a wonderful improvement has taken place in its size there during the last two or three hundred years. When it was first cultivated in Europe—probably in the 16th century—the wild fruit, if it was like what it is now, would be only about one-half an inch in diameter and less than one quarter of an ounce each in weight. The largest gooseberries which have been produced in recent years average several times this size, the largest one of which we have a record weighing 2 ounces, although there are doubtless larger specimens on record. The English and European gooseberries are derived from a species native of north Europe called *Ribes Grossularia.*

The varieties of the *Ribes Grossularia* do not succeed well in Canada or the United States as a general rule, although in some places they do well. The chief obstacle to their successful culture is the Gooseberry Mildew, which it has been found very difficult to control.

As late as 1846 no cultivated varieties of American species of gooseberries were mentioned by writers, the first reference, according to Bailey, being in 1849 in the Northern Fruit Culturist, by Goodrich, where the author writes: 'We have it from good authority that native sorts have been discovered both in New Hampshire and Vermont well adapted to garden culture.' In 1847 the Houghton's Seedling was exhibited at a meeting of the Massachusetts Horticultural Society, this being the first improved form of the native gooseberry of which there is a record. This variety was originated or found by Abel Houghton, Jr., Lynn, Mass. It is probably a seedling of the native species, *Ribes oxyacanthoides.* The first improvement on the Houghton was the Downing, a seedling of the Houghton, which was originated by Charles Downing, Newburgh, N.Y., and first brought into notice in 1853. It is thought by some authorities to have been a hybrid between Houghton and *Ribes Grossularia,* the European species. The Downing is still more largely planted in America than any other variety of gooseberry. This is doubtless largely due to the fact that comparatively little has been done towards improving the gooseberry in America during the past fifty years. The most work seems to have been done by Dr. Wm. Saunders, Director of the Dominion Experimental Farms, the originator of the Pearl, Red Jacket, and many other seedlings and crosses not yet on the market. Descriptions of some of the best of these are published in this bulletin. These varieties were all originated in London, Ont. There is a good field for work in improving the native gooseberries, as there is no apparent reason why the size should not be equal to the best English varieties. The quality of the American varieties is considered by some to be better than the average English gooseberry, but the flavour is not nearly as good as the best of the English sorts.

As the gooseberry is a native of Canada and is found growing wild almost or quite to the Arctic circle, its culture will no doubt be extended very far north. The most

useful native species is the Smooth gooseberry, *Ribes oxyacanthoides,* which is found wild from the Atlantic to the Pacific. Next in importance is the Prickly gooseberry, *Ribes Cynosbati,* which has not so wide a range. It is found from St. John, N.B., to Manitoba. Both of these gooseberries are of good quality. An interesting hybrid gooseberry was originated by Dr. Wm. Saunders by crossing *Ribes Cynosbati* with Warrington, a cultivated English variety. The size of the fruit was increased very much, but the gooseberry although good in quality remained prickly. If greater hardiness is desired it may be got in *Ribes lacustre,* a species which is found generally throughout Canada, and which grows almost or quite to the Arctic circle. In its present state it is not nearly as useful as the other two species, the fruit being smaller and inferior in quality. There are other native species, such as *Ribes Lobbii, R. divaricatum,* and *R. rotundifolium,* which may also play their part in the future improvement of the native gooseberry.

There is a steady though limited demand for gooseberries in Canada, but the gooseberry has never been generally popular in this country. In England gooseberries are used in great quantities for eating out of hand and for jam; in Canada few are used raw, most of the fruit being put into pies, or used as jam, or canned.

PROPAGATION.

Gooseberries may be propagated either from cuttings or by layering. The average person will usually get the best results from layering, as cuttings are often very unsatisfactory. To propagate by layering, the bushes should be pruned severely in the autumn. This will induce a strong growth of young wood the next season. When these have made most of their growth, which will be early in July, the earth is heaped up around and through the bush until only the tips of the young shoots are left uncovered. The soil is packed down and then a covering of loose soil thrown over to retain moisture better. Most of the American varieties will have rooted well by autumn, and the young plants may be detached and planted in nursery rows either the same fall or the following spring, to be grown there for one season. English varieties usually take two years to root, and the soil must be left about the bushes for that time. Cuttings of American varieties will sometimes give fairly satisfactory results if made from well ripened wood and treated as currant cuttings. The cuttings are made six to eight inches or less in length, and buried in soil over winter. In spring they are set out in nursery rows, planting deep enough so that only one or two buds are above ground. Both American and English varieties may be propagated from green wood cuttings in a greenhouse, or hot bed with bottom heat.

SOIL, PLANTING AND CULTURE.

The gooseberry is a moisture-loving plant, hence a soil should be chosen where there will be a constant supply of water during the growing season. In dry soils gooseberries suffer very much in a dry time, the foliage often falling prematurely and the fruit being scalded by the sun. The soil should be a cool one. Moist soils are usually this, but the surface of a sandy loam soil gets very hot in the summer, hence is not the best for this fruit. Well drained, heavy clay loams are the most suitable for gooseberries as these usually are both cool and moist. The soil should have abundant plant food easily made available. A good application of well rotted manure thoroughly worked into the soil will do much to bring about these favourable conditions. The soil should be well prepared and made mellow as for a crop of roots. As gooseberries start to grow early in the spring it is usually preferable to plant in the autumn, and as the leaves drop early they may be planted in September and will be in good condition when winter comes. Well rooted cuttings or layers may be used as plants. They should be set in rows about six feet apart and four feet apart in the rows.

Cultivation should be very thorough so as to retain moisture and keep the soil cool, and as the gooseberry roots near the surface cultivation should be shallow; mulching with straw is sometimes advisable to keep the soil cool.

As the gooseberry makes much more wood than it is desirable to leave, severe pruning is necessary. English varieties are usually trained to a single stem, but this is not necessary, although the freer circulation of air when trained in this way may help to prevent the spread of mildew. The usual custom in America is to grow the gooseberry in bush form. The bush should at first be brought into a good shape by leaving a few of the strongest shoots regularly distributed to make an open head. Five or six of these shoots are quite sufficient to leave at first. As the bush gets older, new shoots are allowed to grow to take the place of the older ones, as the pruning should be done with a view to having only vigorous bearing wood. Fruit is borne on year-old wood and from spurs on older wood. It usually is not desirable to have any wood more than three years old. The best time to prune is in the autumn or winter. The weakest young shoots should be cut off at the ground, also all the stronger young shoots not required for fruiting or to take the place of the older branches to be cut away. The side shoots from the older branches should be headed back or cut out altogether so as to maintain a fairly open head, making it as easy as possible to pick the fruit and yet leaving sufficient wood to produce a good crop and to shade the fruit from the sun, as in a hot dry time gooseberries are liable to be injured by scalding. When branches are more than three years of age they should be removed to make way for younger wood. It is advisable to cut out all branches which touch the ground as there will then be a better circulation of air, and the fruit will be kept off the ground. Gooseberries will often begin to bear the second year after planting, but there will not be a full crop until the fourth season. If the soil is kept in good condition by an annual application of well rotted barnyard manure in the autumn, harrowed in the following spring, and if the bushes are kept sprayed and well pruned, the plantation will not need to be renewed for many years.

YIELD OF GOOSEBERRIES.

The American gooseberry is a productive fruit and averages a good crop if well cared for. It is, however, very important to have good foliage to protect the fruit from the sun, and unfortunately many let the currant worm destroy a large proportion of the foliage, and if the weather is hot the fruit suffers. Six bushes of the Pearl gooseberry have averaged in five years at the rate of 12,402 lbs. per acre per year, or at 40 lbs. to the bushel over 310 bushels per acre. The highest individual yield obtained was in 1905, when five bushes of Pearl 6 x 4 feet apart yielded 75 lbs., or at the rate of 27,225 lbs. per acre, equal to over 680 bushels per acre.

The highest yield mentioned by Card in his work on Bush Fruits, is at the rate of 450 bushels per acre, obtained at the Geneva Experiment Station, N.Y. He gives the probable range from 300 to 500 bushels per acre. Bailey gives the average as 100 bushels per acre, but we believe this is much below what is grown in Canada.

VARIETIES OF AMERICAN GOOSEBERRIES.

The gooseberry has not received the attention it deserves in America, hence the improvement in this fruit though marked has been accomplished by the work of a few men, and as far as can be learned the Houghton and Downing were both produced either by chance or with little labour. To Dr. Wm. Saunders, Director of the Dominion Experimental Farms, is due the credit of introducing two of the three American varieties recommended, namely, the Pearl and Red Jacket. These, with several more of his seedlings, are described after the following short list of American varieties originated by other experimenters.

These all, with the exception, perhaps, of the Pale Red, have some blood of English varieties.

AMERICAN VARIETIES OF GOOSEBERRIES.

Crystal (White).—A strong upright grower, productive; fruit below medium to small, a little smaller than Downing; unattractive; green with paler veins, downy but

not prickly. Skin moderately thick; sweet; of medium quality. Fruit mildews little if any. Season earlier than Downing. Not as good as Downing or Pearl.

Downing.—Originated by Charles Downing at Newburgh, N.Y. A seedling of Houghton. A strong grower and very productive. Fruit of medium size, roundish to oval, pale green with paler and distinct veins and stripes, covered with a whitish bloom; skin smooth, thin; pulp juicy, sweet; skin acid. Quality good. Season medium. This variety is grown more than any other in Canada.

Houghton.—Originated with Abel Houghton, Lynn, Mass. A strong, somewhat pendulous grower, productive. Fruit small, deep red, with a whitish bloom; skin thin; sweet, good flavour. Good quality. This was, until the advent of the Downing, the most popular gooseberry, and is by some preferred to Downing even yet on account of its great hardiness and good quality.

Pale Red.—An old variety much like Houghton but smaller; not desirable.

Smith (Improved).—A seedling of Houghton originated by Dr. Smith, Windsor, Vt. A strong grower and productive, but not as productive as Downing or Pearl. Fruit oval, medium to below medium, dull pale green sometimes with red spots. Skin thin; sweet. Good quality. Fruit does not average as large as Downing.

GOOSEBERRIES ORIGINATED BY DR. WM. SAUNDERS, DIRECTOR, DOMINION EXPERIMENTAL FARMS.

The extent of the work done by Dr. Wm. Saunders, Director of the Dominion Experimental Farms, in originating currants and gooseberries is well told in a paper on that subject prepared by himself, which will be found elsewhere in this bulletin. The following varieties of gooseberries are the best of Dr. Saunders' productions. The Pearl and Red Jacket have been on the market for a number of years, the others have not yet been introduced.

Deacon.—A seedling of Downing. A strong, moderately upright grower, and productive, but not so productive as Pearl. Fruit of medium size, oval, yellowish green, smooth, sweet, good flavour. Quality good, better than Pearl. Season medium. Is affected very slightly with mildew. A good variety.

Richland.—A cross between Houghton (female), and Ashton's Seedling (male). A strong, moderately upright grower, moderately productive. Fruit of medium size, nearly round, dull bronzy red, smooth. Pulp sweet, good flavour, but skin acid and tough. Quality medium to good. Season medium. Mildews very slightly. Not as promising as some others.

Mabel.—Record of parentage lost. A strong, moderately upright grower and very productive, yielding about as much as Pearl. Fruit above medium size, averaging larger than Downing and Pearl, rounded to oval, pale green, translucent; sweet but not high flavoured, and of medium quality. Season medium. Fruit does not mildew. This is the most promising variety for commercial purposes.

Duncan.—A hybrid between *Ribes Cynosbati,* female, and Warrington (*Ribes Grossularia*), male. A strong, upright grower, moderately productive. Fruit above medium size, oval, dull coppery red, quite prickly; skin thick; sweet with much of the wild flavour. Quality above medium to good. Season medium. This variety is more interesting than useful, but it has very distinct characteristics, and may be a useful parent in the future improvement of the gooseberry.

Alma.—A seedling of Downing. A medium grower, moderately upright. Not very productive. Fruit of medium size, not quite as large as Downing or Pearl, oval to oblong, green with more or less coppery red, slightly downy but not prickly; skin thick; sweet; quality medium to above. Season late. The chief value of this variety lies in its lateness, which may make it useful. Fruit occasionally mildews a little.

Pearl.—A cross between Downing and Ashton's Seedling or Broom Girl. Named by A. M. Smith, St. Catharines, Ont., and introduced by him in 1888. Bush a strong, moderately upright grower, very productive. Fruit of medium size, or about the same size as Downing, roundish to oval, pale green with paler and distinct veins or stripes, smooth; skin acid; pulp juicy, sweet. Quality good. Season medium. Does not mildew. This variety has proved more productive than Downing at the Central Experimental Farm, but otherwise cannot be distinguished from that variety. See Plate 3.

Flora.—A cross between Houghton (female), and Ashton's Seedling (male). This variety cannot be distinguished from Downing and Pearl, and the same description will apply. It has been nearly as productive as Pearl.

Silvia.—Record of parentage lost. A strong, moderately upright grower; not very productive. Fruit above medium size, roundish, green more or less covered with dull red, smooth; subacid, good flavour; good quality; season medium. Fruit seldom mildews and is never more than slightly affected. A fine gooseberry if it were more productive.

Ralph.—Record of parentage lost. A strong, moderately upright grower, not as hardy as some and not very productive. Fruit medium to below medium in size, a little smaller than Downing and Pearl, roundish to oval, dull yellow when ripe, downy but not prickly; skin thin; sweet; quality above medium. Season early. This is the earliest variety tested, and may be useful on that account.

Red Jacket (Josselyn).—Named and introduced by Geo. S. Josselyn, Fredonia, N.Y. A cross between Houghton and Warrington. A strong grower and productive, but not as productive as Pearl and Downing. Fruit above medium size, larger than Downing, roundish to oval, green, more or less covered with coppery red, smooth, subacid, sprightly, good flavour; good quality. Season medium. Does not mildew. A good variety.

Gibb.—A strong grower, but not more than a medium bearer. Fruit above medium to large, roundish to oval, dull red and green, smooth; sweet; sprightly, but skin acid, good flavour; good quality. Fruit very little affected with mildew. Is of good size and quality and would be a good commercial variety if more productive.

Rideau.—A strong grower and a good bearer. Fruit medium to above medium in size, roundish, green with paler prominent veins, smooth; skin moderately thick, tender; sweet, sprightly; quality good. Practically unaffected by mildew. Resembles Downing and Pearl but not so productive.

Ruth.—A strong grower and productive. Fruit of medium size, oval, sharply tapering at each end, but more enlarged at stem end, making a distinct characteristic; green with paler veins or ribs, smooth; skin thick; sweet and subacid; quality medium; season later than Pearl or Downing. Does not mildew.

Saunders.—A vigorous grower, but a rather light bearer. Fruit large, nearly round, sometimes almost oval, brownish red, smooth; sweet, sprightly and of fine flavour; quality very good. One of the largest and best flavoured seedlings. Practically no mildew on fruit.

ENGLISH GOOSEBERRIES.

In England the gooseberry is one of the most popular fruits, and great quantities of gooseberries are grown there every year. They are used to a large extent for eating out of hand when ripe, but are much in demand for making jam. Owing to their large size and good flavour, and their popularity in England they were early imported into America, but it was soon found that owing to the gooseberry mildew the English varieties could not be successfully cultivated in most places where the gooseberry grows. Where the climate approaches nearest to that of England, and there is considerable moisture in the air, not very high summer temperatures, and considerable cloudy weather the English gooseberry succeeds best. Even in gardens where there is

Pearl Gooseberry. (Plate 3.)

a great deal of vegetation giving off much moisture, and where the soil is shaded and cool good success is often obtained and almost or quite as fine gooseberries produced as in England, but such instances are the exception. It is claimed that the gooseberry mildew can be controlled under some conditions by persistent spraying with potassium sulphide in the proportion of 1 lb. to 2 gallons of water, but to obtain satisfactory results the weather must be favourable and the bushes sprayed from four to six times or more. In our experience we have found that it is often not possible to control this disease by spraying.

Heavy clay soils are most suited to the gooseberry and there is little use trying to grow the English varieties in light soils. Clay soils are cool, and with them it is easier to obtain the conditions necessary to success. Various methods are recommended for growing English gooseberries free from mildew. Mulching the soil heavily with straw is one. Mulching the soil with coal ashes is another. Shading the soil with laths set on a frame eight or ten feet high is another. All these methods are useful, but unless the air is moist above as it is cool and moist below the conditions will be still more or less favourable for the development of the disease. The conditions of a thickly planted garden, where there is partial shade, seem the most favourable.

At the Central Experimental Farm 106 English varieties have been tested, many of them for about fourteen years, for the purpose of learning which would be freest from mildew. The soil where they were tested is not as heavy as was desirable, but it was the heaviest that could be obtained, and to make the conditions more favourable clay was drawn and mixed with the soil. None of the varieties have done well, but below will be found descriptions of the eleven which have produced the cleanest fruit:

LIST OF ENGLISH GOOSEBERRIES TESTED AT THE CENTRAL EXPERIMENTAL FARM, OTTAWA.

Admiration, Alcock King, Alma, Amber, Antagonist, Archville, Aston Red, Bank of England, Beauty, Bobby, Bright Venus, British Crown, Briton (Cook's), Broom, Bumper, Carleton, Carman, Champagne, Champion Red, Chautauqua, Cheshire Lass, Clayton, Companion, Conquering Hero, Cox's Late Green, Crown Bob, Dan's Mistake, Dickson's Yellow, Duck Wing, Eagle, Early Orange, England, Faithful, Fillbasket, Full Moon, Game Cock, Gascoigne, Glenton Green, Greenfield, Green Mountain, Heart's Oak, Henry II., High Sheriff, Hit or Miss, Industry, Ironmonger, Kean's Seedling, Keepsake, King Cole, King of Trumps, Lady Houghton, Lady Leicester, Lancashire Lad, Lancashire Summer, Lancer, Leveller, Lily of the Valley, Lion's Provider, Lomax Victory, Loudon, Lord Derby, Marigold, Moses, Mountain of Snow, Napoleon le Grand, Ottawa, Peru, Philip the First, Ploughboy, Prince Regent, Princess Royal, Profit, Queen Anne, Queen of Trumps, Railway Yellow, Red Hambro, Red Robin, Red Wonder, Riccardo, Rifleman, Ringer, Robson's Favourite, Rover, Royal George, Sheba's Queen, Shiner, Slaughterman, Smiling Beauty, Snowball, Snowdrop, Souter Johnny, Speedwell, Sportsman, Sulphur, Tally Ho, Trumpeter, Walnut, Wandering Girl, Whitesmith, White Angler, White Eagle, White Warrington, Yellow Creeping June, Yellow Criterion, Yellow Sulphur, Yorkshire Green.—106.

English Varieties of Gooseberries Least Affected with Mildew at the Central Experimental Farm, Ottawa.

Alcock King.—Fruit large, oblong, bright green with paler stripes or veins, smooth, moderately sweet; quality medium.

Antagonist.—Fruit medium size, roundish, bright green with paler stripes or veins, smooth; moderately sweet, good flavour; quality above medium.

Companion.—Fruit above medium size, roundish, green, but with a more or less bronze shade, almost smooth; sweet, but skin is acid; good flavour; good quality.

Eagle.—Fruit above medium size, oval to oblong; bright green, with paler stripes or veins, smooth; sweet, good flavour; quality good.

Glenton Green.—Fruit medium to small, oval, greenish yellow, slightly downy; sweet; good quality.

Queen Anne.—Fruit medium size, roundish to oval, yellowish green; smooth; skin thick; briskly subacid; quality medium to above.

Queen of Trumps.—Fruit below medium size, oval, yellowish green, slightly downy; sweet, good flavour; good quality.

Riccardo.—Fruit large, oval, dull or copper red, almost smooth; sweet, sprightly, good flavour; quality very good. This is one of the best in quality.

Snowball.—Fruit large, oval to oblong, bright green with paler stripes; smooth; moderately sweet; medium quality.

Trumpeter.—Fruit large, oval to oblong, somewhat pear-shaped, yellowish green; smooth; skin thick; moderately sweet; quality medium.

Yellow Criterion.—Fruit medium size, oval, green; skin thick; sweet; medium quality.

English Varieties Usually Recommended as Being Least Affected with Mildew.

Industry (Whinham's).—Fruit medium to large, roundish to oblong, sometimes pear-shaped, dark red, moderately hairy; sweet, good flavour; good quality. A very good cropper where it succeeds. Has mildewed badly here.

Whitesmith.—Fruit medium to large, roundish to oval, yellowish green; smooth; skin moderately thick; sweet, good flavour; good quality. Usually considered one of the most reliable. Has mildewed considerably here.

Varieties of English Gooseberries which have Succeeded Best with Mr. R. B. Whyte, Ottawa.

English gooseberries have been very successfully grown at Ottawa in the garden of Mr. R. B. Whyte, where the moisture given off by the great amount of vegetation, together with the coolness of the clay soil in his garden, make the conditions least favourable to the gooseberry mildew. Mr. Whyte is not troubled with mildew in the least, and does not spray.

The following six varieties have succeeded best with Mr. Whyte, who has furnished the descriptions of them:—

Triumph (White).—In shape and colour like Whitesmith, but about one-quarter larger. Never mildews. Very productive; quality as good as Whitesmith.

Lofty (Green).—Long shape, somewhat pointed at the ends; very large; of fine quality.

Green Ocean (Green).—Oblong in shape; large; good quality; productive.

Conn or *Autocrat* (Dark green).—About the same size as Whitesmith; very productive, vigorous and hardy; good quality.

Weatherall (Greenish yellow).—Round; very large; slightly hairy; extra fine quality.

Sportsman (Dark red).—Not quite as large as Whitesmith; somewhat shy bearer, but very early and high quality; one of the best for dessert.

Experience of Stanley Spillett, Nantyr, Ont., formerly in charge of one of the Ontario Fruit Experiment Stations.

In the annual report of the Fruit Experiment Stations of Ontario, for 1903, Mr. Stanley Spillett, Nantyr, Simcoe County, Ont., gives his experience with English gooseberries:—

'The fruit of the foreign varieties, and their seedlings, was not affected by mildew, but the foliage was so badly mildewed that it all fell off. The mildew made its

appearance on June 16, and in two weeks the stems were bare of leaves, so the fruit never ripened properly, and was not fit for use.

'Autocrat gave the largest crop of fruit of the foreign varieties. The berry is very large, but of poor quality.

'Large Golden Prolific, Columbia, Whitesmith, Chautauqua, Queen, and Dominion, bore a large crop of fruit, and are very much alike in fruit and bush. All mildewed as I have described.

'Crown Bob and Keepsake were well loaded with very large berries; so was Crosby's Seedling, and Lancashire Lad. Crosby's Seedling gave the largest berries this season.

'Green Chisel was loaded, but the fruit is poor in quality. All the other pure English varieties, sent to the station in 1896, have gradually died out, till now, out of six each of 50 varieties, I have besides Green Chisel, only a dozen small, stunted bushes.

'Success is identical with Downing, and Oregon Jumbo with Red Jacket. Golden Prolific and Keen's Seedling are worthless.

'Ontario is a beautiful, large berry, and the bush is very vigorous for a foreign seedling. Yellow Scotch is not up to Whitesmith. Taken all around, I find Whitesmith the best foreign variety. The bush is a good grower.

'To those who have soil and climate favourable to the growth of the foreign varieties, I say, do not send to Britain for plants, but use those already acclimatized, such as Whitesmith. I have found the old country plants utterly lacking in vigour. A gentleman three miles south of my place has grown Industry for years, and has yet to see the first speck of mildew, while Industry with me never fails to rot with mildew, so there are places in Ontario favourable for their growth.

'Green Chisel has succeeded the best of any variety received here from the old land, and yet, after ten years, the bushes are no larger than Pearl at three years from sucker.'

Varieties of English Gooseberries Recommended by Mr. J. C. Chapais, St. Denis, Que.

In order to learn how English gooseberries were succeeding along the lower St. Lawrence, where the summer is cooler and the air moister than at Ottawa, a letter was sent to Mr. J. C. Chapais, St. Denis, who lives in latitude 47° 30′, near the St. Lawrence nearly 100 miles below the city of Quebec. Mr. Chapais writes:—

'In answer to your letter of January 28, asking for information on the English gooseberries, I beg leave to say that I have had under cultivation the following: Chautauqua, Columbus, Golden Prolific, Industry, Keepsake, Lancashire Lad, Whitesmith. I have dropped Industry and Golden Prolific because they mildewed awfully; Keepsake and Lancashire Lad because they did not amount to much as to bearing, and I have kept and consider as very good, highly productive and absolutely free from mildew the varieties Chautauqua, Columbus and Whitesmith. Columbus is the best of the three last mentioned. I have these under culture for over ten years.

'I do not know much about other growers cultivating English gooseberries around here.'

VARIETIES OF GOOSEBERRIES RECOMMENDED.

American.—Pearl, Downing, Red Jacket.

English (from experience at the Central Experimental Farm).—Companion, Eagle, Glenton Green, Queen of Trumps, Snowball.

English Varieties Usually Recommended.—Whitesmith, Industry.

SCALDING OF THE FRUIT.

In a very hot, dry time gooseberries are often scalded, become unfit for use and fall to the ground. If the gooseberries are planted in heavy, cool soil and the ground kept well cultivated and the Saw-fly prevented from eating the foliage there will be little trouble. Unfortunately, in many plantations the foliage is very scant, either on account of poor cultivation or injury from the worm of the Saw-fly, and it is under such conditions that the greatest injury occurs.

DISEASES OF THE GOOSEBERRY.

GOOSEBERRY MILDEW *(Sphærotheca mors-unvæ)*.—The Gooseberry Mildew has prevented the general culture of the English gooseberry in America. This disease attacks the leaves, twigs and fruit. When the attack is bad it destroys the foliage, covers the fruit and causes most of it to drop. It saps the growing shoots to such an extent that they do not ripen properly, and dry up without setting fruit buds. It thus practically destroys the crop. The disease is apparent early in the season in the web-like covering which coats the leaves, shoots and fruit. This is the mycelium from which is given off the spores which propagate this disease. It is usually noticed first in the lower and most shaded parts of the bush. When the spores are being given off, the mildew has a powdery appearance. Winter spores are formed later which germinate in the spring. As the mycelium and spores are both on the surface it might be thought this disease could be easily controlled, but the weather conditions in this country seem so favourable to the development of spores that the gooseberry mildew spreads with great rapidity, and constant and thorough spraying are necessary to prevent it from doing so. American varieties are seldom affected by gooseberry mildew, although occasionally they are slightly attacked.

Experiments were conducted at the Central Experimental Farm in 1891, and the following results obtained:—

Five applications were made in each case.

1. Potassium sulphide, 1 oz. dissolved in 3 gallons of water gave the best results, keeping the foliage practically healthy and free from disease the whole season.
2. Potassium sulphide, 1 oz. to 4 gallons, stood second in order of effectiveness.
3. Ammoniacal copper carbonate, 3 ozs. to 25 gallons, stood third and was fairly effective.
4. Suspension mixtures of copper carbonate did not give a sufficient degree of immunity to pay for cost of materials and time of application.

The experiment was continued in 1892, with the following results:—

1. Sprayed with potassium sulphide; no mildew appeared on the fruit of any of the sprayed plants.
2. Plants treated with Bordeaux mixture had healthier foliage and retained it longer than those treated with potassium sulphide or ammoniacal copper carbonate.

In 1891 a bulletin (Bulletin 10), was published, in which the treatment with potassium sulphide was recommended.

An experiment was tried in 1897 by shading the plants from the sun's rays on the south, east and west sides with Indian corn planted in hills about two feet from the bushes. It is reported that the plants protected were healthier than those not protected.

Bordeaux mixture was again tried in 1897 in the early part of the season, and when it began to stain the fruit a weak solution (1 pound to 160 gallons water) of copper sulphate was applied. This proved fairly effective. Weekly applications were, however, necessary in order to hold the disease in check. The weak copper sulphate solution seemed quite as effectual as ammoniacal copper carbonate, is easier prepared and exceedingly cheap.

In 1899 experiments were continued with potassium sulphide, 1 oz. to 2 gallons; potassium sulphide, 1 oz. to 3 gallons; calcium sulphide, 1 oz. to 1 gallon; calcium

sulphide, 1 oz. to 2 gallons; formalin, 1 oz. to 1 gallon; Bordeaux mixture (sulphate of copper 4 lbs., lime 4 lbs., water 40 gallons), with the following results:—

Potassium sulphide, 1 oz. to 2 gallons. This gave the best results as far as the fruit was concerned. The leaves of the bushes were, however, nearly all destroyed by the spray. Berries were only slightly affected with mildew.

Potasium sulphide, 1 oz. to 3 gallons. This was almost as effective as the last, and injured the leaves about as much.

Calcium sulphide, 1 oz. to 1 gallon. The results were no better than those not sprayed, as leaves and fruit were badly affected with mildew.

Calcium sulphide, 1 oz. to 2 gallons. The mildew on the fruit was lessened, but the foliage was destroyed by the fungicide.

Formalin, 1 oz. to 1 gallon. The results were not encouraging. While the fruit was not quite as bad as unsprayed it was unfit for market.

Bordeaux mixture. While this kept the leaves in good condition, preventing the spread of mildew on them, the fruit was considerably affected and unfit for market.

Unsprayed. The leaves and fruit were badly affected.

In 1902 a determined effort was made to prevent the spread of mildew, but it was only partially successful. Beginning when the leaf buds where breaking on April 18, the bushes were sprayed thoroughly every week with potassium sulphide in the proportion of 1 oz. to 2 gallons of water. This was continued until June 5, when traces of mildew being noticed the bushes were sprayed twice a week until July 19, making 20 sprayings in all. Notwithstanding the thorough and constant application of this fungicide the leaves dropped badly from most European varieties, though what fruit remained on the bushes was not nearly so much affected as usual.

During the past few years asparagus has been grown between the rows of gooseberries to afford shade, but it develops too late, which also applies to Indian corn. If partial shade is desired it should be had early in the season, before the disease has spread much, hence the shade of shrubs or trees which leaf out early is desirable.

REMEDIES.

Potassium sulphide (1 oz. to 2 gallons water), has on the whole given the best results at the Experimental Farm, although in some instances the foliage was injured by it. This remedy is recommended by the New York Experiment Station, to whom belongs the credit of discovering it in 1887. Early applications are very important, beginning when the leaf buds are breaking and continuing at intervals of a week to ten days. About five or six sprayings will be necessary, but if the weather is unfavourable more may have to be given. The bushes should be sprayed from beneath as well as from above. The centre of the bush should receive the spray also. In fact, the whole bush should be thoroughly sprayed.

Calcium sulphide may prove as useful as potassium sulphide, as one year's test made showed that the disease was prevented from injuring the fruit, although the foliage was injured that season.

From the experiments conducted at the Central Experimental Farm fair results have been obtained by spraying with Bordeaux mixture when the leaf buds are breaking, and again just before blooming, following as soon as the flowers fall, and continuing at intervals of a week or ten days, with a weak solution of Bordeaux mixture, 1 lb. to 160 gallons water, or with ammoniacal copper carbonate. The spraying must be thorough and persistent and continued until the gooseberries are nearly full grown. The under side of the leaves should be sprayed as thoroughly as the above, otherwise the disease will not be checked. The early applications are very important.

LEAF SPOT—RUST *(Septoria ribis)*.—The disease which causes the spotting of gooseberry leaves and their falling prematurely is the same as that which affects currants, and may be dealt with in the same way.

INSECTS INJURIOUS TO CURRANTS AND GOOSEBERRIES.

(By JAMES FLETCHER, *Dominion Entomologist.*)

The various kinds of injurious insects which attack red, white and black currants and cultivated gooseberries, although more attracted to one or other kind of these plants, occasionally injure the others also, so that it is possible and more convenient to treat of them all in one article. The different kinds are arranged alphabetically under their best known popular name.

AMERICAN CURRANT BORER (*Psenocerus supernotatus,* Say).—When red and white currants are leafing out in spring, some bushes are noticeably slower in expanding their foliage than other individuals of the same variety. This is frequently due to the presence of stem-boring larvæ, either those of the above beetle, which are white, cylindrical, and without feet, about a quarter of an inch in length, or those of the imported Currant Borer, which somewhat resemble the above but have a brown head and short legs beneath the body. The parent of the American Currant Borer is a small, narrow, brownish-black beetle, about ¼-inch long, with long slender feelers and two conspicuous white spots on the back towards the end of the body, and two smaller dots about the middle. These beetles may sometimes be found in the month of June crawling about upon the bushes. The eggs are laid in summer, and the young grubs burrow inside the canes and do not change to pupæ until the following May. The attack of this insect, although occasionally serious to fruit growers, is only an exceptional one, for the species propagates much more freely in the stems of the Virginian Creeper.

Remedy.—When currant bushes are being pruned, all the wood which is cut out should be burnt, and if the presence of this insect or of the Currant Borer is detected by the black burrows in the centres of the stems, such stems should be pruned down until the larva is found, so that it may be destroyed.

CURRANT APHIS (*Myzus ribis,* L.).—When the leaves of currant bushes are nearly full grown, many of them bear blister-like elevations of a reddish colour, beneath which will be found yellowish plant-lice, some winged and some wingless. The blisters are due to the attacks of these insects, and when, as is sometimes the case, they are very abundant, considerable injury is done to the bushes.

Remedy.—Spraying forcibly with whale-oil soap solution or kerosene emulsion will destroy large numbers of these plant-lice at each application; but the liquid must be copiously applied and driven well up beneath the foliage by means of an angled nozzle. Two or three applications at short intervals may be necessary.

CURRANT BORER (*Ægeria tipuliformis,* L.).—Early in June a beautiful little bluish-black fly-like moth, with three bright yellow bands around the body may be seen darting about around or at rest on the leaves of currant bushes of all kinds. This is one of the most troublesome enemies of these fruits. The moth lays an egg at a bud on the young wood, and the caterpillar, when hatched, eats its way into the cane and destroys the pith. It remains in the wood during the winter, and the moth emerges during the following summer.

Remedy.—As in the case of the American Currant-borer, close pruning is the best remedy.

CURRANT MAGGOT (*Epochra canadensis,* Loew.).—Red, black and white currants, in British Columbia and in several places in the Northwest Territories and Manitoba, have of recent years been seriously attacked by the maggots of a small fly. These maggots come to full growth just as the berries are about to ripen, causing them to fall from the bushes, when the insects leave them and burrow into the ground to pupate. Attacked fruit is rendered useless by the presence of the maggots inside the berries; and frequently it is not until the fruit is cooked that the white maggots can be detected. Gooseberries are sometimes injured, but far less frequently than black and red currants.

Remedy.—The only treatment which has given any results is the laborious one of removing about three inches of the soil from beneath bushes which are known to have been infested, and replacing this with fresh soil. That which was removed must be treated in some way, so that the contained puparia may be destroyed. This may be done either by throwing it into a pond or by burying it deeply in the earth.

CURRANT SOFT-SCALE (*Lecanium ribis,* Fitch).—There are occasionally noticed upon the stems of currants and gooseberries clusters of large swollen dark-brown polished scales, about $\frac{1}{10}$ of an inch in diameter, beneath which, when mature in July, large numbers of white eggs may be found. These hatch during that month, and the small, mite-like young crawl all over the plant and suck the sap from the leaves and young growth. By autumn they have grown but little and are covered with a flat brown scale about $\frac{1}{32}$ of an inch in length. As winter approaches, they crawl on to the twigs and pass the winter there. During the spring of the next year they grow rapidly, and, as they are sometimes in such numbers as almost to cover the twigs, they do a considerable amount of harm by sucking the sap at the time when the bushes require all their vigour to ripen fruit.

Remedy.—Spraying the bushes in winter time either with the lime-sulphur wash or with kerosene emulsion, is the best treatment for this scale.

CURRANT SPAN-WORM (*Cymatophora ribearia,* Fitch).—This voracious caterpillar, which frequently does much harm to currants and gooseberry bushes, but particularly to the black currant, is more difficult to control than the common Currant Worm, the larva of the Imported Currant Sawfly. The caterpillars are about an inch in length, of a whitish colour, with yellow stripes down each side, and one down the middle of the back; the whole body is dotted with black spots of different sizes. There is only one brood of this insect in the year, the moths appearing about the end of June and in the beginning of July. The eggs are laid on the twigs during the latter month, and remain there unhatched until the following spring. The caterpillars may be found during June.

Remedy.—It is necessary to use a much stronger poison for the Currant Span-worm than for the ordinary Currant Worm. Paris green, arsenate of lead, or some other arsenical poison, are preferable to the white hellebore usually recommended. When occurring only in small numbers, hand-picking is practicable, owing to the habit of the caterpillar of letting itself down by a strong silken thread, when the bushes are disturbed.

In addition to the above, which is the commonest of the span-worms found on gooseberries and currants, there are occasionally found two much larger caterpillars of the same shape and looping movement of the body when walking. These are those of the Currant Angerona (*Xanthotype crocataria,* Fab.), which has a caterpillar an inch and a half long or more when full-grown, of a yellowish-green colour, with a whitish line down the back and a broad white band on each side bordered with pale purple, below the spiracles, and the Pepper and Salt Currant Moth (*Lycia cognataria,* Gn.), which has a large caterpillar two inches long, varying in colour from green to dark brown, and when at rest standing out rigidly, like many of the other span-worms, so as to resemble a twig or the stem of a leaf. Neither of these latter caterpillars is a regular pest of the small fruit grower; but they occasionally appear in such numbers as to require attention. They are easily controlled by the same remedies as given above.

CURRANT LEAF-HOPPER (*Empoasca mali,* Le Baron).—A frequent cause of considerable injury to the leaves of currants and gooseberries, is a small pale green leaf-hopper which during May and June is found in large numbers beneath the leaves, from which it sucks the sap. This is the same insect as is often so abundant upon apple trees, and has received various names from different authors. Perhaps the best known is *Empoa albopicta,* which was given to it by Dr. S. A. Forbes. The mature insect is a slender leaf-hopper less than $\frac{1}{8}$ of an inch in length, and passes the winter beneath rubbish, leaves, &c. It flies to the bushes in spring, as soon as they leaf out. The

young wingless leaf-hoppers of the first brood may be found about the beginning of June, and should be destroyed before they develop their wings and propagate.

Remedy.—Spraying the bushes with kerosene emulsion or whale-oil soap solution before the insects become winged, is the best remedy. Care must be taken to drive the liquid well up under the leaves.

CURRANT WORM OR IMPORTED CURRANT SAWFLY (*Pteronus ribesii*, Scop.).—By far the best known of all the insects which injure currants and gooseberries, is the 'Currant Worm.' The black spotted dark green false-caterpillars of this insect may unfortunately be found in almost every plantation of currants or gooseberries, every year in almost all parts of Canada. The white eggs are laid in rows along the ribs of the leaf on the lower side, towards the end of May. From these the young larvæ hatch and soon make their presence known by the small holes they eat through the leaves. Unless promptly destroyed, they will soon strip the bushes of their leaves, thus weakening them considerably so as to prevent them ripening fruit the first year, and also reducing the quality of the crop of the following season. There are at least two broods in a season in Canada. The first appears just as the leaves are attaining full growth, and the second just as the fruit is ripening. The perfect insect is a four-winged fly which may be seen flying about the bushes early in spring. The male is blackish, with yellow legs and of about the same size as a house fly, but with a more slender body. The female is larger than the male and has the body as well as the legs yellow.

Remedy.—For the first brood a weak mixture of Paris green, 1 ounce to 10 gallons of water, may be sprayed over the bushes, or a dry mixture 1 ounce of Paris green to 6 pounds of flour may be dusted over the foliage after a shower or when the leaves are damp with dew. For the second brood Paris green must not be used, but white hellebore; this is dusted on as a dry powder, or a decoction of this powder, 1 ounce to 2 gallons of water, may be sprayed over the bushes. It is, of course, far better to treat the first brood thoroughly, so as to reduce the number of females which would lay eggs for the second brood.

FOUR-LINED LEAF-BUG (*Pœcilocapsus lineatus*, Fab.).—An occasional injury of no very great importance, as a rule, to the leaves of currants and gooseberries, is by the Four-lined Leaf-bug. The eggs of this insect are inserted into the twigs of bushes, particularly currants. They are usually placed near the tips and protrude slightly through the bark. As they are white, they can be easily seen and, when once known, can be recognized again without difficulty. Much good may be done in controlling this insect by cutting off all egg-bearing twigs when pruning. The mature insect is a flat, bright green or yellow bug, with four black lines down the back and with the tips of the wings and two large round spots on the thorax also black. The nymphs or immature bugs occur with the adults near the tips of shoots and are exceedingly active. These insects puncture the young leaves of currant and gooseberry bushes as well as of many other kinds of plants, causing brown spots which are sometimes so numerous and close together as to make the leaves wither.

Remedy.—When, as is generally the case, only a few bushes are attacked, shaking off the nymphs and perfect insects into open pans containing water with a little coal oil on the top, is often sufficient. If the attack is more extensive, spraying the bushes with kerosene emulsion or whale-oil soap solution will destroy all the insects reached by the spray. The winter is passed in the egg state, therefore, all egg-bearing twigs should be cut off and burnt.

GOOSEBERRY FRUIT-WORM (*Zophodia grossulariæ*, Riley).—Just before gooseberries ripen, clusters of two or three may sometimes be noticed, which are prematurely coloured, and which are joined together by the webs spun by the caterpillar of a small moth. These caterpillars are pale greenish-white and sometimes have a reddish tinge. They live inside the berries and, when the contents of one berry are consumed, attack another near at hand, joining it to the first by a silken web. When full grown they fall to the ground and spin brown parchment-like cocoons, just beneath the surface of

the ground. The moths, which are pale grey, marked with dark streaks and bands, are very rarely observed. They fly early in spring, and there is only one brood in the year.

Remedy.—The best method of controlling this insect, which fortunately is never very abundant, is to pick by hand the clusters of injured berries. It is claimed that chickens and other poultry are useful in destroying the larvæ and chrysalids; and it is certain that, while chickens are very small, they are useful in a garden in destroying a great number of injurious insects. The old hen, however, should be kept securely cooped up and not allowed to run at large.

IMPORTED CURRANT BORER.—*See* CURRANT BORER.

IMPORTED CURRANT SAWFLY.—*See* CURRANT WORM.

OBLIQUE-BANDED LEAF-ROLLER (*Archips rosaceana,* Harr.).—Late in May and during June the leaves at the tips of young shoots of currants of all kinds may be seen gathered together by active pale green caterpillars about ¾ inch long, with black heads. Upon tearing the leaves apart, these wriggle quickly out of their shelters and fall to the ground. When full grown, which is during June, the caterpillars change to brown chrysalids inside their tents, and from these a little later the moths appear. These are flat and broad in shape, resembling a bell in outline when at rest. The front wings are light brown crossed by broad oblique bands of a darker tint. The hind wings are of a pale ochre yellow. The moth expands about an inch across the wings. The caterpillars are very general feeders and may be found on a great number of trees and shrubs.

Remedy.—Spraying bushes with Paris green and water to destroy the first brood of the Currant Worm, will control this caterpillar also, as it occurs about the same time. The clusters of leaves containing the larvæ are easily noticed and should be pulled apart and the caterpillars killed whenever detected.

OYSTER-SHELL SCALE (*Mytilaspis ulmi,* L.).—Several kinds of scale insects attack currants and gooseberries. These plants seem to be particularly susceptible to the attacks of the well known Oyster-shell Scale of the apple, and the San José Scale. In neglected plantations these injurious insects increase rapidly, and a great deal of injury results to the trees.

Remedy.—The remedies for scale insects are direct treatment for the destruction of the infesting insect, and preventive measures such as the invigoration of the tree by special culture and pruning, to enable it to throw off or outgrow injury. Infested plantations should be cultivated and fertilized early in the season, and all unnecessary wood should be pruned out. As direct remedies, spraying the bushes at the time the young scale insects first appear in June with kerosene emulsion or whale-oil soap, or spraying in autumn before the hard weather of winter sets in with a simple white-wash made with one pound of lime in each gallon of water, give the best results. Two coats of the white-wash should be applied, the second one immediately after the first is dry. In putting on two thin coats of the wash instead of one thick one, far better results have been secured. For the San Jose Scale the lime and sulphur wash is necessary, and must be repeated every year.

'RED SPIDER' (*Tetranychus* species).—In dry years great injury is occasionally done in plantations of currants and gooseberries, as well as on raspberries, apples and many other kinds of fruits, by various species of spinning mites which are usually spoken of in a general way, by horticulturists, under the name of 'Red Spiders.' These are all very minute reddish, or greenish white, mites that are found on the lower surfaces of the leaves, which they cover with a fine network of web in which they live and which renders it difficult to get at them with ordinary liquid applications. These minute creatures propagate very rapidly, and their injuries to trees by sucking out the juice of the leaves is very soon apparent by the bleached appearance of the foliage, which soon dries up and falls away.

Remedy.—It is probable that most of the kinds of 'Red Spiders' pass the winter as eggs on the bushes. Plantations which have been infested one year, should be thoroughly sprayed early in spring with the lime and sulphur wash. Sulphur has a specially fatal effect upon all kinds of mites. If bushes are found to be infested in spring or summer time, they should be sprayed forcibly with kerosene emulsion, which might be followed in persistent attacks, which often occur, by dusting the bushes while wet with powdered sulphur by means of one of the so-called insect-guns or horticultural bellows.

THE RASPBERRY.

The raspberry is the most popular bush fruit in Canada. Beginning to ripen just as the strawberry season is over, a supply of this fruit is kept up for three or four weeks during the hottest part of the summer, when, owing to its refreshing character, it is very much appreciated when eaten raw with cream and sugar, and is used in this way in large quantities. Not only is the raspberry popular in the raw condition, but it is very generally used for canning and preserving. Raspberries, when made into 'raspberry vinegar,' make a very refreshing drink which is especially appreciated in the country.

Owing to its hardiness and to the fact that it will succeed fairly well with comparatively little care, the raspberry is grown by almost everyone who grows fruit at all.

The following information regarding the history of the raspberry was prepared by Mr. John Craig, when horticulturist of the Central Experimental Farm, and published in Bulletin, 22. He obtained much of this information from the Michigan Experiment Station Bulletin 111 on 'The Cultivated Raspberries' of the United States, by Prof. A. A. Crozier, to whom he gives credit. In writing of the wild red raspberry of Europe, the native wild red raspberry, and the native black cap, he gives the following particulars:—

'The first was known and apparently cultivated by the ancient Greeks, who traced its origin to Mount Ida, where it flourished wild, and from which it received its name, *Rubus Idæus*. Paladius, a Roman agricultural writer of the fourth century, mentions the raspberry as one of the cultivated fruits of his time. From the gardens of southern Europe it found its way into France, the Low countries, and England, and from these sources into the United States. To this species belong the red and white Antwerps, which have remained standards of excellence for upwards of a century, the Hudson River Antwerp, Franconia and other similar varieties. These foreign sorts, though often abundant bearers of large, finely flavoured fruit, as Mr. Crozier further points out, have not proved adapted to the climatic conditions of the United States, and this is also true with regard to Canada, owing to a lack of hardiness and a liability to be injured by our hot summer suns. "These defects finally directed attention to our native raspberries. The black cap (*Rubus occidentalis*) seems to have been the first of these to have been brought into cultivation, and from the time of the earliest settlements we hear of the wild bushes being occasionally removed to the gardens." Prof. Macoun, of the Geological Survey of Canada, kindly furnishes the following particulars regarding the distribution of this species in Canada: "*Rubus occidentalis* has a very restricted range both to the north and west. It is sparingly found in New Brunswick, quite common in Quebec, west of that city and through Ontario to Lake Huron, though apparently absent from Toronto westward to Lake Erie. On the west coast this species is replaced by one very like it named *Rubus leucodermis*, which is common on Vancouver Island, and has been collected as far east as the Columbia River valley, 100 miles south of Revelstoke.

In the east *R. strigosus* and *R. occidentalis* hybridize and form a species (?) named by Prof. Peck, *R. neglectus*. In the west *R. strigosus* and *R. leucodermis* form a hybrid which is far superior to *R. neglectus*. This form grows in abundance at Sicamous, B.C., close to the C.P.R. station, where it was found fruiting finely in July, 1889." *Rubus leucodermis* in its native state appears quite promising, but as yet has furnished no variety adapted to general cultivation.

"The first distinct variety of black cap (*Rubus occidentalis*) of which we have record, is the Ohio Everbearing, which attracted attention as early as 1832, from its habit of fruiting to a greater or less extent upon the young canes in autumn. For a family garden this was considered to be a desirable feature, though no varieties of this class ever found favour for market purposes. The yellow form of the black cap, represented by Golden Cap and other varieties, was introduced about the same time. The Doolittle next came into notice, about 1850, and attained considerable prominence." (Crozier).

'In some districts of the United States black raspberries are extensively cultivated for drying, the "Ohio" being one of the favourite varieties grown for this purpose.

'Our native red raspberry has a wider range than the black cap, extending especially much farther northward. Prof. Macoun also furnishes me with the following particulars regarding the distribution of this species: "*Rubus strigosus* has a very wide range in Canada, passing without a break to the Coast Range in British Columbia. Mr. Low found it in Labrador on the height of land at the source of the Ungava river, down which it descends to Lat. 57°. Mr. J. B. Tyrrell brought back specimens from the "Barren Grounds" gathered in Lat. 62° 17′, Long. 103″ 07′ west. Miss E. Taylor collected it in the delta of the Mackenzie river, on Peel's river, 30 miles north of the Arctic circle, and lastly Mr. James McEvoy gathered abundance of ripe fruit on the Yukon, north of Lat. 62°. I have gathered specimens in the mountains at an altitude of 7,000 feet. It will be seen by the above that it has a very wide range."

'Mr. Crozier further states that "This species does not take so kindly to cultivation (as the black cap), and the origin of our varieties belonging to it is often obscure; we have but few well authenticated examples of the species in its purity having been brought from the wild state into cultivation, and most of these soon disappear. The evidence by which certain of our well known red varieties are assigned by botanists (doubtless correctly) to the native species is mainly structural, and not historical, since nearly all have originated, directly or by descent, as chance or artificial seedlings upon cultivated ground. That our native red raspberry has played a large and perhaps controlling part in the production of our most popular hardy red raspberries need not be denied, but the doubt which we are obliged to recognize on this point rests on circumstantial evidence too strong to be entirely overlooked."

'The purple raspberry, of which we have such a notable example in "*Shaffer*," was first designated a distinct species, but recent investigations point to hybrid origin. This assumption appears to be well grounded, owing to the fact that nearly all hybrids between the black and the red raspberry produced here and elsewhere, have borne purple fruit, much resembling the "*Shaffer*" in colour and flavour as well as habit of growth. Prof. Saunders has probably fruited more true hybrids of this class than any other experimenter, the majority of which were intermediate in habit of growth and character of fruit. Their good points are vigour and productiveness; their weak points are the softness and acidity as well as unattractive colour of the fruit.

SOIL.

(From Bulletin 22 C. E. F.)—'All varieties of red raspberries do not succeed equally well on the same kind of soil. For instance, varieties of foreign extraction (*Rubus Idæus*), such as "Clarke," "Hornet" and "Brinckle's Orange" do not flourish on sandy or light soils, but are more at home on a deep, rich, moist soil that is rather compact. On light soils their leaves are apt to burn in summer, which prevents the canes from maturing perfectly, and consequently renders them liable to injury by

winter. For most varieties of raspberries a cool, loamy soil, moist, but not sodden, will usually give the best results.

'The black raspberry, on the other hand, seems equally at home on sand or loam, and on well drained clayey soils; but on heavy compact soils which are cold, it does not thrive. Anyone who has attempted to grow black caps in cold and sodden soil will readily appreciate the truth of this statement. In ground of this kind the canes are subject to disease, are easily winter killed and prove generally unprofitable.

SUITABLE PLANTS FOR SETTING OUT.

'It is well to remember that the raspberry plant is a perennial in regard to its roots. The canes which are produced this year bear fruit the following summer, and die in the autumn of that year. Thus, although the roots are perennial the canes are biennial only, existing only for two years.

'In the case of suckering kinds the best plants are obtained from the vigorous shoots of the previous year's growth. These may be taken up and set out either in the fall or in the spring; or during a rainy season the young sprouts may be transplanted successfully after the middle of June and up to the middle of July.

'When fall planting is found convenient, it may be done usually with greatest success during the first half of September. Setting out at this time encourages immediate root growth, which assists in carrying the plant through the winter and favours a vigorous growth in spring. All plants should be cut back within six or eight inches of the ground at the time of transplanting.

'Black caps, known as "tip varieties," are multiplied by the tip bending down to the ground and striking root. This usually takes place after the fruiting season is over; in this latitude, from the middle of September to the middle of October. Propagation is facilitated by covering the tips of the canes with sufficient soil to hold them down.

'Care should be exercised in planting these tips in order to prevent them from being set too deep, as if covered with more than two inches of soil they are apt to be smothered. In buying plants which have to be shipped some distance, it is usually best therefore to order one-year old plants of the black cap instead of young "tips" which are more difficult to ship and transplant successfully. By taking this precaution a large percentage of failure will be avoided.

'The stools or root clusters of both red and black raspberries may be taken up and divided in order to form a new plantation, but this method is not to be recommended, as old stools rarely make a vigorous growth, and much better results will be obtained by starting with young plants.

PREPARATION OF THE SOIL.

'Labour spent in securing a thorough preparation of the soil, including deep ploughing and liberal manuring, will always repay the small fruit planter.

'If the soil is light in character, it should be heavily dressed with barnyard manure in the spring, after being brought into a good state of tilth by growing on it a hoed crop the previous season. If of a clayey nature, it should be adequately drained, and the texture may be improved by ploughing under a green crop such as clover or peas.

'Sub-soiling is not always absolutely necessary, but is always attended with good results, and should be practiced when the under soil is hard and of a retentive character. In other cases where the surface soil is shallow and the underlying soil hard, unless it is loosened by means of a sub-soil plough, following the furrow of the ordinary turning plough, the roots will be unable to penetrate deep enough to obtain a sufficiency of moisture during periods of dry weather. In all gardening operations on a scale large enough to admit of its use, the sub-soil plough should be brought into play.

'The necessary amount of hand labour involved in weeding subsequent to planting, will be greatly lessened by allowing no weeds to go to seed the previous year.

'In brief, select when possible, deep, loamy, well drained soil; if this is not available bring the most desirable piece of ground into good condition by draining, subsoiling and manuring. Raspberries, like strawberries, are not often, nor are they easily injured, by too heavy manuring, the error is generally on the other side.

PLANTING, CULTIVATING AND PRUNING.

'In field culture, suckering varieties, red, purple and yellow, should be planted in rows six to seven feet apart, and three feet apart in the row. The rows should be accurately measured and indicated by stakes previous to planting. The work of planting is much facilitated by carefully opening with a plough a furrow 4 or 5 inches deep in the line of the row for the reception of the plants. Two plants may be set in a hill, using a hoe to fill in the soil, which should be carefully compacted. Setting out two shoots to begin with, ensures a much better and evener growth in the whole field, than if a single cane is used in each case, and fewer failures will result if this plan is adopted. The cultivator, which should be started as soon as the planting is done, will effectually complete the filling of the furrow.

'Black caps may be planted in rows in the same way. They are also successfully grown by planting in hills four or five feet apart each way. This method allows of very thorough cultivation by horse-power, thus greatly lessening the amount of hand labour.

'The canes of black raspberries should be cut back each season when they have reached a height of two, to two and a half feet; unless treated in this way they are difficult to manage. This pinching back causes the plants to grow stocky and to throw out laterals. The laterals may be cut back to a length of 12 to 15 inches in the autumn; but the best plan is to leave them till the following spring when the injured wood, if any, may be removed at the same time. The bearing wood should be removed as soon as the fruiting season is over. Experiments carried on here during the past two years, and still in progress, have not indicated any striking advantage from leaving the removal of the old wood till spring. There is generally more time to attend to this work in early autumn, than during the hurry of spring work.

'Clean culture with all fruit crops always pays best. In the case of the raspberry, this is particularly true. Frequent shallow cultivation will keep down weeds, and preserve the moisture of the soil, often lacking during the season of fruit harvesting. A superfluous growth of suckers in the case of red raspberries, may be kept under by the cultivator and the vigour of the canes in the row thereby increased. Satisfactory results are also obtained by some growers, by mulching with straw or coarse manure instead of cultivating. With comparatively limited areas and situated within easy distance of a cheap manure supply, suburban gardeners can by mulching heavily in this way with strawy manure, grow a greater number of plants to the row, and obtain fruit of undiminished size. Some growers mulch the rows of plants only, leaving a strip in the centre of the inter space, which is kept clear of weeds by the horse cultivator. Weeds which appear in the rows are hoed out, or pulled by hand. Under ordinary conditions, when the plants are not thinned to something approaching a hill system, the fruit becomes small and the plants lose vigour.

'The Illinois experiment station bulletin No. 30, reports the result of an experiment designed to show the benefit of cultivating the black raspberry throughout the summer, as against cultivation during the latter part of the season, after the fruit was picked. The experiment was carried on for four years, with the result that the area kept cultivated from early spring until fall, yielded 500 boxes more than the same area cultivated from the time the fruit was taken off, until fall.

TRAINING.

'In this district, there are two principal methods of growing the red, yellow and purple raspberry, viz.: (1) growing tall canes which are bent over and covered in the autumn for better winter protection; (2) growing shorter canes and thus increasing the likelihood of their being covered naturally, by snow fall.

'Canes which are to be covered should be grown to a height of from 5 to 6 feet, this usually necessitates very little pinching back during summer. In the autumn or immediately after the fruit is picked, the old canes are thinned out, leaving four to six shoots in each hill; the hills being about three feet apart. To bend down and cover these without fear of breaking them, a little earth is taken out on one side of the hill, the canes are then collected in a bunch, and pressed down in the line of row by means of a fork in the hands of one man, while sufficient earth is applied to the canes to hold them down, by another man. The cost of the labour involved in covering an acre should not exceed $5. By this method larger and finer fruit may be obtained earlier in the season than without protection, and it is the best method for the amateur. Some commercial growers in cold regions follow this practice successfully, while others do not find it satisfactory. In cultivating the suckering varieties of the raspberry for market, it will depend somewhat on the situation and the varieties grown, whether it will pay the grower to adopt this plan or follow the next outlined.

'The other method, that of keeping the plants low by summer pruning, is the one usually adopted. To carry this out properly, the canes should be pinched back when they have attained a height of from fifteen to twenty inches (when the climate is not severe they may be grown taller as stated above). This will cause them to throw out laterals, which in turn should be pinched after making a growth of 12 or 15 inches. Sometimes this second pinching is deferred till the following spring. This system develops a very sturdy and stocky bush and one which is less liable to be injured by winter's cold—because usually covered by snow—than one grown by the former plan and left unprotected.

TRELLISES OR SUPPORTS.

'It should be mentioned in connection with the first system—protecting in winter—that a trellis is necessary to support the canes after uncovering them in spring. Unless a trellis is used, mulching the ground will be essential in order to keep the fruit from being soiled during rain and wind storms. A cheap trellis can be constructed with little trouble by using posts 5 feet long, made of 2 by 6 inch planks, and driving them edgewise across the rows, at distances of 3 to 4 rods apart. A single wire stapled to the outside of these posts will be sufficient to hold the canes in place, and prevent them from being borne to the ground by the weight of the fruit, or by rain or wind. Another plan is to use posts made of 2 by 4-inch scantling. Cross pieces 15 to 18 inches in length are nailed on the posts about three feet from the ground. The ends of the cross pieces are notched. The wire is nailed to the end posts of each row, and is held in place by the notches in the cross pieces into which it is laid. This method allows of the easy removal of the wire when desired.

'In garden culture, it always pays to grow the canes in hills. Each hill should be supplied with a stake to which the canes may be tied. In brief, it may be stated that with winter protection, trellising or mulching is necessary. Without winter protection in the colder regions, growers run the risk of occasional injury to the plants, sometimes amounting to the loss of a crop, and besides are unable to grow the European varieties of raspberries with uniform success.'

EXPERIMENTS IN PROTECTING RASPBERRIES IN WINTER AND IN PINCHING BACK IN SUMMER.

In the years 1894, 1895 and 1896 experiments were conducted at the Central Experimental Farm by protecting some canes in winter and leaving others not protected, and by pinching back the canes in summer as compared with those not so treated. The results for 1896 are given in the following statement and table, which is taken from the report of the horticulturist for that year:—

'Of the following 17 varieties of red raspberries, each was made up of two rows 165 feet in length. One row was summer pruned—that is the young growth was nipped back when it had reached a height of 15 to 20 inches. The old wood was also taken from the plants in this row the previous season as soon as the fruit had been harvested. The other row was left untouched as far as pruning was concerned till this

spring when the old canes were removed and the dead tips shortened back. These rows have received for three years this kind of treatment. In the autumn the plants occupying half the length of each row have been laid on the ground, placing over the prostrate ends sufficient soil to hold them down. Records are submitted giving the yields obtained from the parts of the rows under the different treatments; of the total yield of each variety and of the relative amount of injury sustained during winter.

Raspberries, 1896.	Pruned, 160 Feet.				Not Pruned, 160 Feet.				Date of First Picking.	Date of Last Picking.	Yield of Pruned Row.	Yield of Unpruned Row.	Total Yield in Boxes from 320 ft.	Estimated Yield in Boxes per Acre.
	Protected.		Unprotected.		Protected.		Unprotected.							
	Scale of injury 1—10.	Yield of 80 feet.	Scale of injury, 1—10.	Yield of 80 feet.	Scale of injury, 1—10.	Yield of 80 feet.	Scale of injury, 1—10.	Yield of 80 feet.						
Heebner	9	5¾	4	4¾	10	11½	5	7¾	July 11.	Aug. 1	10½	19¼	29¾	677
Springfield	9	7	7	4	9	11	7	6½	do 2.	do 4.	11	17½	28½	649
Royal Church	2	¾	2	1½	4	3½	5	2½	do 21.	do 1.	2¼	5¾	8	182
Carman	7	15¾	5	7¼	9	26¼	8	13¼	do 2.	do 8.	23	39½	62½	1,422
Thompson's Early Prolific	8	13¼	7	8	9	28¼	7	18½	do 2.	do 8.	21¼	46¾	68	1,547
Herstine	7	7	4	4	9	14½	6	6½	do 11.	do 8.	11	21	32	728
Parnell	8	8½	4	3½	8	7¾	5	4½	do 7.	do 8.	11¾	12¼	24	546
Golden Queen	5	3	5	2¾	8	9¼	5	8	do 16	do 8.	5¾	17¼	23	524
Reider	8	7½	4	3¼	8	7¼	4	2½	do 11.	July 29.	10¾	9¾	20½	467
Brandywine	8	10¼	6	6	9	12¾	7	7¼	do 7.	Aug. 8.	16¼	20	36¼	825
Niagara	7	8	4	4	9	12½	6	6¾	do 7.	do 4.	12	19¼	31¼	711
Marlboro	7	1½	4	1	9	9¼	5	5	do 7.	July 27.	2½	14¼	16¾	381
Hansell	8	6	6	3¾	10	13	7	5	do 2.	do 29.	9¾	18	27¾	632
Clarke	7	5	5	3	8	7	5	2½	do 11.	Aug. 4.	8	9½	17½	399
Cuthbert	7	3¾	4	1¼	9	6¾	7	4¾	do 13.	July 29.	5	11½	16½	376
Turner	9	6¼	6	5¼	9	4¾	6	4¼	do 7.	Aug. 1.	11½	9	20½	467
Caroline	8	11	6	5½	9	21¼	7	11	do 7.	do 8.	16½	32¼	48¾	1,109

'It will be seen (1) that the protected plants were least injured by winter—10 representing no injury, the descending scale indicating increased injury; (2) the yields from the pruned and unpruned rows show a balance again (see Report, 1895, p. 107) in favour of the latter in almost every instance; (3) the protected rows show the larger yields in almost every instance. This last result is quite in line with each year's experience as regards the desirability of protecting raspberries during winter at Ottawa. That the unpruned canes should outyield their fellows pruned, is not in keeping with orthodox teaching upon this point, and suggests the desirability of fruit growers looking carefully into this matter.'

These results have been confirmed by subsequent experiments conducted at the Wisconsin Experiment Station where red raspberries pinched back in summer did not yield so well as those not thus treated.

Pinching back in summer is attended with some risk in certain sections, especially if not done in good time, as after pinching back, the young growth sometimes grows too late, causing winter killing. The best plan is to head back to the desired height in the spring.

VARIETIES OF RED, PURPLE AND YELLOW RASPBERRIES.

Raspberries have been very thoroughly tested at the Central Experimental Farm, and most of the varieties of American origin which are now offered for sale have been tried, as well as many of the European sorts. In the following table will be found the average yields obtained from 43 of these varieties during the past three years. It may be noticed that Cuthbert is not included in the table. The reason for this is that the Cuthbert, like many other varieties, has proved too tender at the Experimental Farm.

and in the present plantation it has never got properly established and has borne practically no fruit. The Marlboro comes low in this table, which is due partly to the fact that it has not got well established. A fairer estimate of its relative productiveness will be found in the short table following the table below. Heebner is another variety which has not got well established, hence the yield is not published, as it would be misleading, the Heebner being a fairly productive variety. Loudon has never proved productive at Ottawa as it lacks vigour, and on the sandy loam soil here produces very little fruit. Columbian and Shaffer are so frequently injured by winter that the average yield of these varieties is small.

RED AND YELLOW RASPBERRIES—YIELD OF VARIETIES.

AVERAGE OF FOUR YEARS.

Average rank.	Number of years averaged.	Name.	First ripe, 1904.	First ripe, 1905.	First ripe, 1906.	Average date of first ripe Fruit.	Average total yield.	
							Lbs.	Oz.
1	3	Herbert	July 12	July 8	July 13	July 11	36	7¾
2	3	Shinn	" 8	" 12	" 13	" 11	28	2
3	3	Brighton	" 5	" 8	" 12	" 8	27	13
4	3	Sir John	" 2	" 7	" 12	" 7	24	13
5	3	Kenyon	" 2	" 9	" 13	" 8	24	7¾
6	3	Muriel	" 2	" 7	" 12	" 7	24	7¼
7	3	Count	" 5	" 7	" 12	" 8	23	1¼
8	3	Deacon	" 7	" 11	" 13	" 10	21	7¼
9	3	Cardinal	" 5	" 12	" 13	" 10	20	13
10	3	Henry	" 5	" 7	" 13	" 8	17	7¼
11	3	Reliance	" 5	" 9	" 13	" 9	16	7¼
12	3	Nelson	" 9	" 11	" 13	" 11	16	6¾
13	3	Turner	" 2	" 9	" 13	" 8	15	13
14	3	Lorne	" 8	" 11	" 14	" 11	15	7¼
15	3	Herstine	" 9	" 11	" 13	" 11	15	4
16	3	Biggar's Seedling	" 8	" 12	" 18	" 13	14	14¼
17	3	Caroline	" 9	" 11	" 15	" 12	13	11¾
18	3	Craig	" 9	" 12	" 15	" 12	12	9¼
19	3	Knevetts	" 7	" 8	" 15	" 10	12	7¼
20	3	Clarke	" 7	" 9	" 15	" 10	11	11¼
21	3	Columbian	" 16	" 12	" 18	" 15	11	9¼
22	3	Sarah	" 19	" 17	" 21	" 19	10	12¼
23	3	Phoenix	" 6	" 9	" 13	" 9	10	10¼
24	3	Hiram	" 6	" 12	" 20	" 13	10	9¼
25	3	Brandywine	" 13	" 12	" 16	" 14	10	7¼
26	3	Red Antwerp	" 13	" 12	" 15	" 13	8	12
27	3	Hornet	" 7	" 12	" 15	" 11	8	8
28	3	Marlboro	" 2	" 10	" 13	" 8	7	12¼
29	2	Loudon	...	" 12	" 13	" 12	7	12
30	2	Gladstone	...	" 12	" 15	" 13	7	4¾
31	3	Mary	July 13	" 12	" 17	" 14	7	1¼
32	3	Shaffer	" 14	" 16	" 21	" 17	6	10¼
33	3	Semper Fidelis	" 14	" 15	" 15	" 15	6	7¾
34	3	Thompson's Early Prolific	" 2	" 9	" 12	" 8	5	15
35	2	King	...	" 9	" 13	" 11	5	15
36	3	Rancocas	July 10	" 9	" 13	" 11	5	9¼
37	3	Hansell	" 6	" 9	" 12	" 9	5	5
38	2	Baumforth	...	" 12	" 20	" 16	5	1¾
39	2	Golden Queen	...	" 15	" 16	" 15	4	15¼
40	3	Belle de Fontenay	July 12	" 12	" 16	" 13	4	13
41	3	Magnum Bonum	" 7	" 8	" 16	" 10	4	11¼
42	2	Yellow Antwerp	" 10	" 12	" ..	" 11	4	10¾
43	3	Royal Church	" 12	" 12	" 13	" 12	3	7

Six Most Productive Varieties, 1900-1903.

In the former table the Marlboro, which is the standard early variety, comes low on the list owing to the fact that the plants were not as well established in the new plantation as some others. The following table will give a fairer idea of its relative

Herbert Raspberry. (Plate 4.)

productiveness in a former plantation with Brighton and Count, two of the early ripening seedlings originated by Dr. Wm. Saunders. The yields are from a four years' average. The Cuthbert during that time only averaged 4 lbs. ½ oz., as it does not succeed well, being too tender.

Name of Variety. — Red Varieties.	Date of first ripe fruit, 1903.	Average date of first ripe fruit, 1900-03.	Date of first picking, 1903.	Average date of first picking, 1900-03.	Date of last picking, 1903.	Average date of last picking, 1900-03.	Number of pickings, 1903.	Average number of pickings, 1900-03.	Total yield, 1903.		Average total yield, 1900-03.		Length of row, feet.
									Lbs.	oz.	Lbs.	oz.	
Brighton	July 1.	July 6.	July 2.	July 9.	July 27.	Aug. 4.	12	11	28	6½	19	10½	36
Kenyon	" 1.	" 10.	" 2.	" 12.	Aug. 10.	" 10.	16	12	16	14½	16	7	36
Count	" 1.	" 6.	" 2.	" 9.	July 27.	" 3.	12	11	16	3	16	6½	36
Henry	" 1.	" 5.	" 2.	" 9.	" 29.	" 2.	13	10	20	8½	16	0	36
Clarke	" 5.	" 9.	" 7.	" 12.	Aug. 10.	" 12.	13	13	12	12½	15	14½	36
Marlboro	" 5.	" 8.	" 7.	" 11.	July 31.	" 3.	11	11	9	9½	14	10	36

YIELD OF RASPBERRIES.

The crop of raspberries, like most other fruits, depends largely on climatic conditions, and even though the best variety is planted, if the season is unfavourable or the plantation has not been cared for properly, the yield will be much lessened. As a rule it will be found that the more the crop can be increased by special care the greater the profits will be, the extra labour and expense made being much more than repaid for by the increased crop and additional revenue. A crop of raspberries, according to Bailey, ranges from 50 to 100 bushels per acre. Card found that the average yield of red raspberries estimated from the information received from 56 growers is about 69 bushels per acre. At the Central Experimental Farm the average yield of the Herbert raspberry for the past two years on one row 90 feet in length was at the rate of more than 205 bushels per acre, or about 6,586 lbs. From two rows, each 18 feet in length, or one row 36 feet long, the average yield for the past three years was over 229 bushels per acre, or 7,357 lbs. The average yield of the Brighton from two rows each 18 feet in length was over 175 bushels per acre, or 5,602 lbs. The highest individual yield was obtained from the Herbert in 1904, which produced 50 lbs. 12 ozs. of fruit from two rows each 18 feet in length, or one row 36 feet long, which is at the rate of 10,234 lbs. per acre, or 319 bushels 26 lbs., estimating a bushel at 32 lbs.

While these large yields are from small plots, they show the possibility of increasing the average yield throughout the country very much.

VARIETIES OF RASPBERRIES RECOMMENDED.

For General Culture—

Red.—Early—Brighton, Count, Marlboro.
Main Crop.—Cuthbert, Herbert.
Yellow.—Golden Queen.
Purple.—Columbian, Shaffer.
Black Caps.—Hilborn, Older, Gregg, Smith Giant.

For Home Use—

Red.—Herbert, Sarah, Clarke, Heebner.
Yellow.—Golden Queen.
Purple.—Columbian.
Black Cap.—Hilborn, Older, Gregg, Smith Giant.

Hardiest Varieties—

Red.—Brighton, Count, Herbert, Sarah, Turner.
(Loudon has proved one of the hardiest in the Northwest).
Purple.—Shinn.
Yellow.—Golden Queen.
Black Cap.—Hilborn, Older; Cumberland, a new variety, is promising.

RED AND PURPLE RASPBERRIES.

DESCRIPTIONS OF VARIETIES.

Baumforth.—Originated as a seedling with John Baumforth, Pontrefract, England. A strong grower, but quite tender here. Fruit of medium size, roundish, deep red; soft; juicy, briskly subacid; medium quality. Season late. Not desirable.

Belle De Fontenay.—Introduced from Europe about 1850. A strong grower, not hardy enough for this district. Fruit above medium to large, conical, deep red; drupes large; moderately firm; juicy, briskly subacid, with a pleasant flavour; quality good. Season medium. Might be useful if hardier.

Biggar's Seedling.—Originated by Mr. C. N. Biggar, Drummondville, Ont. A strong grower and moderately productive. Fruit medium to above medium in size, conical, bright red; moderately firm; fairly juicy, subacid, good flavour, and of good quality. Season later than most. A good variety, but not quite hardy enough at Ottawa.

Brandywine.—Originated near Brandywine Creek, Wilmington, Del. A chance seedling. A strong grower, but a light cropper at Ottawa owing to its tenderness. Fruit medium to above medium in size, somewhat conical, deep red; moderately firm; fairly juicy, subacid; quality above medium. Season medium. Not desirable.

Cardinal.—Originated with A. H. Griesa, Lawrence, Kansas, in 1888, and is probably a seedling of Shaffer, but is propagated by both tips and suckers. A strong grower and productive, but not as hardy as some others. Fruit medium in size, roundish or slightly conical, deep purplish red; moderately firm; juicy, acid; medium quality. Season medium. Not desirable.

Clarke.—Originated by E. E. Clarke, New Haven, Conn., about 1857. Resembles the European raspberry more than the American. A strong grower and quite productive when not injured by winter, but on the whole it is comparatively hardy. Fruit above medium to large, conical, bright red; rather soft; juicy, briskly subacid, good flavour and of very good quality. A good variety for home use.

Columbian.—Originated with J. T. Thompson, Oneida, N.Y. A seedling of Cuthbert probably pollenized by Gregg. The seed from which this grew was planted in 1888. It was introduced about 1894. A strong growing tip variety and very productive when uninjured by winter. Fruit large, roundish conical, dark purplish red; firm; moderately juicy, briskly subacid and of good flavour; good quality. Season late. Milder and firmer than the Shaffer, which it resembles very much.

Cuthbert (Queen of the Market).—Originated with Thomas Cuthbert, Riverdale, N.Y. Distributed by the Rural New Yorker in 1880. A strong grower, but only moderately hardy. At Ottawa it is only satisfactory in sheltered gardens. At the Experimental Farm it has proved practically a failure owing to winter-killing. Where it is hardy enough it is quite productive, and is the standard main crop variety wherever it will succeed in Canada. Fruit large, conical, deep red; firm; moderately juicy, subacid, good flavour and of good quality. Season medium. We believe that the Herbert will replace the Cuthbert for home use when it is better known, as it is juicier, as large, and quite as good in quality.

Eaton.—Introduced by A. Garretson, Pendleton, Ind. This variety has not been tested long enough to judge of its relative merits here, but at the New York Agricultural Experiment Station, Geneva, N.Y., it is reported: 'Not equal to standard varieties on account of habit of crumbling and low quality.'

Gladstone.—A chance seedling originating with Chas. Carpenter, Kelley's Island, Ohio, and introduced by him in 1886 under the name of Carpenter's No. 2. Introduced by Green's Nursery, Rochester, N.Y., in 1891, under the name of Gladstone. A strong grower, but tender and unproductive at Ottawa. Fruit of medium size, roundish, purplish red; soft; juicy, subacid, good flavour and of good quality. Season medium. Not desirable.

Columbian Raspberry.

Hansell.—A chance seedling originating on the farm of J. S. Hansell, near Beverly, N.J., about 1875. Introduced by J. F. Lovett in 1882. A medium grower, hardy but not productive here. Fruit small to medium, roundish, rather dull red; moderately firm; juicy, subacid; quality medium to above medium. Season early. Not large enough nor productive enough.

Hoebner.—Originated with W. W. Hilborn, Leamington, Ont. Grown from seed of the wild raspberry found in Muskoka. A strong grower, hardy, and quite productive. Fruit large, roundish to conical, deep red; moderately firm; juicy, subacid, good flavour and of very good quality. Season medium. A good variety. Somewhat like Clarke. Resembles the European more than the American raspberry.

Herbert (No. 17.)—A chance seedling originating with R. B. Whyte, Ottawa, Canada, in 1887. One of 30 seedlings, probably of Clarke. A very strong grower, hardy, and very productive. Fruit large to very large, obtusely conical, bright to rather deep red; drupes medium size, not crumbling; moderately firm; sweet and subacid, sprightly, juicy and of good flavour; quality very good. Season begins a few days before Cuthbert. The best red raspberry tested here. It has all the good points required in a berry for local market, being hardy, vigorous, productive, with fruit of large size, good colour and very good quality. If firm enough for distant shipment it may displace Cuthbert. See Plate 4.

Herstine.—Originated with D. W. Herstine, Philadelphia. A seedling of the Allen, named in 1870. A strong grower and moderately productive. Fruit above medium to large, conical, deep red or crimson; moderately firm; juicy, briskly subacid, good flavour and of good quality. Season medium. A good berry but not as hardy, as large, nor as productive as Herbert.

Hiram.—Introduced by John Lewis Childs, Floral Park, N.Y., in 1893. It is of the European type. A strong grower, but winter-kills badly. Is productive when not much injured. Fruit large to very large, bright red, conical; rather soft; juicy, subacid, good flavour; quality very good. Season medium. Should make a good home berry in a milder climate.

Hornet.—This variety originated near Paris, France, and was introduced into America about 1858. A strong grower, but a light cropper at Ottawa owing to its being too tender. Fruit medium to large in size, roundish, red; drupes large; soft; juicy, briskly subacid, pleasant flavour and of good quality. Season medium. Too tender at Ottawa, and too soft for a commercial berry.

Kenyon.—Introduced by O. A. Kenyon, McGregor, Ia. Found growing among black raspberries about 1885. A strong grower and productive. Fruit medium to above medium in size, roundish, deep, purplish red; firm; juicy, acid; quality medium. Season early. Not attractive in appearance, but hardy and productive.

King.—Introduced by the Cleveland Nursery Co., Rio Vista, Va., in 1892. A medium to strong grower and a good cropper when uninjured by winter. Moderately hardy. Fruit medium to above medium in size, round, bright red; moderately firm; fairly juicy, briskly subacid; of medium quality. Season early. Not promising.

Knevetts.—An English variety. A strong grower and would probably be productive if hardier. Fruit above medium to large, roundish conical; deep red; moderately firm; juicy, subacid; of pleasant flavour and of good quality. Not hardy enough at Ottawa.

Loudon.—Originated by Frank W. Loudon, Janesville, Wis. Introduced in the fall of 1894 by C. A. Green, Rochester, N.Y. A weak to medium grower, hardy but not productive at Ottawa. Fruit medium to large, conical, bright red; firm; moderately juicy, subacid, sprightly and of good flavour. Quality good. Season medium. Not vigorous, not productive enough. Has proved one of the hardiest varieties in the Prairie provinces.

Marlboro.—Originated by A. J. Caywood, Marlboro, N.Y. A cross between Highland Hardy and another cross, the parents of which were the Globe and Hudson River. Introduced in 1884. A moderately strong grower, hardy, and usually productive. Fruit above medium size, roundish or slightly conical, bright red; firm; moderately juicy; of medium quality. The standard early variety. Brighton and Count are early and are better croppers.

Miller.—Originated at Wilmington, Del. Only moderately vigorous, and rather tender. Has not proved productive at Ottawa. Fruit of medium size, roundish, bright to dark red; drupes large; firm; moderately juicy, briskly subacid; quality above medium. Not a promising variety.

Phœnix.—A strong grower, hardy, and moderately productive. Fruit above medium to large, roundish, deep red; firm; moderately juicy, subacid; of medium quality. Hardiness and firmness are its two best characteristics.

Rancocas.—Originated as a chance seedling on the farm of J. S. Hansell on Rancocas Creek, Pa. Introduced by Wm. H. Moon, Morrisville, Pa., in 1884. A medium grower, not productive here. Fruit above medium size, roundish, deep red; moderately firm; fairly juicy, briskly subacid; quality above medium. Season early to medium. Not desirable.

Red Antwerp.—An old European variety and still one of the best of that class. A medium grower and a light cropper here owing to winter-killing. Fruit of medium size, roundish, deep red; moderately firm; juicy, subacid and of good flavour. Quality good. Season medium. Not hardy enough at Ottawa.

Reliance.—Originated by O. L. Felton, Merchantville, N.J., and exhibited at the Centennial Exhibition in 1876. Descended from the Philadelphia through several generations of seedlings. A medium grower and moderately productive. Fruit of medium size, roundish, deep red; drupes large; firm, juicy, briskly subacid. Medium to poor in quality. Season medium. Hardier than most, but not otherwise valuable.

Marlboro Raspberry.

Royal Church.—A chance seedling, originating with Mr. Royal Church, Harrisonville, Ohio. Introduced by C. A. Green, Rochester, N.Y., in 1893. A medium to strong grower. Has not proved productive. Fruit of medium size, roundish, bright red; drupes large; moderately firm; juicy, briskly subacid, good flavour; good to very good quality. Season medium. Not very promising except for quality.

Semper Fidelis.—An old English variety. A strong grower, but not hardy enough. Fruit above medium to large, conical, rather deep red; firm; moderately juicy; acid, sprightly; quality above medium. Season medium.

Shaffer (Colossal).—A chance seedling found in the garden of Geo. Shaffer, Scotsville, Monroe Co., N.Y. Introduced by Chas. A. Green, Rochester, N.Y., in 1878. A very strong grower, moderately hardy, but not quite hardy enough at Ottawa. Very productive when canes are uninjured by winter. Fruit large, roundish or slightly conical; dark purplish red; moderately firm; juicy, acid, sprightly; quality above medium.

Season medium to late. Not attractive enough for general market. Propagated by tips.

Superlative.—An English variety introduced into America by Ellwanger & Barry in 1892. Only moderately vigorous, tender. Fruit large, conical, deep red, attractive; rather soft; juicy, of good flavour and of good quality. May be useful for home use where climate is mild.

Thompson's Early Prolific.—A chance seedling introduced by the Cleveland Nursery Co., in 1888. A strong grower and fairly hardy, but not productive. Fruit of medium size, round, slightly flattened; red; moderately firm; juicy, subacid; quality medium. Season early. Not desirable.

Turner.—Originated about 1835 with Prof. J. B. Turner, Jacksonville, Ill. A very strong grower, very hardy and moderately productive. Fruit medium to below medium in size, conical, deep red; soft; juicy, subacid, good flavour; good quality. Season early. The Turner much resembles a wild raspberry, and is thought to be merely a chance wild seedling. Useful where extreme hardiness is desired, but too small for general use.

YELLOW RASPBERRIES.

DESCRIPTIONS OF VARIETIES.

Caroline.—A cross between Brinckle's Orange and Yellow Cap, by S. P. Carpenter, New Rochelle, N.Y. A strong grower, but not very productive at Ottawa on account of winter-killing, but quite productive where it succeeds well. Fruit medium in size, roundish, deep orange; soft; juicy, briskly subacid; medium quality. Season medium. It is one of the hardiest yellows but not hardy enough at Ottawa.

Golden Queen Raspberry.

Golden Queen.—A chance seedling found by Ezra Strokes, Berlin, N.J., growing among Cuthbert about 1880. Supposed to be a sport of Cuthbert. A medium grower, usually considerably or badly injured by winter at Ottawa, which has reduced the average crop very much. Fruit medium in size, conical, golden yellow; soft; sweet,

subacid, good flavour and of good quality. Season medium. The best yellow variety, taking everything into consideration.

Magnum Bonum.—An old English variety. A medium grower and too tender to be productive here. Fruit medium to above medium in size, roundish or slightly conical, deep yellow; rather soft; juicy, briskly subacid, pleasant flavour; good quality. Season medium. One of the best flavoured yellows.

Orange (Brinckle's Orange).—Originated with Dr. D. W. Brinckle, of Philadelphia, and fruited first in 1845. A weak grower and entirely too tender at Ottawa. Fruit above medium in size, conical, and of a clear orange yellow in colour; soft; juicy, good flavour and of good quality. One of the best flavoured yellow varieties.

Yellow Antwerp.—An old European variety. A strong grower, but too tender to be productive at Ottawa. Fruit medium to above medium in size, roundish, deep yellow; rather soft; juicy, sweet, subacid, pleasant flavour and of good quality. Season medium. One of the best flavoured yellows, but not hardy enough.

RASPBERRIES ORIGINATED BY DR. WM. SAUNDERS, DIRECTOR DOMINION EXPERIMENTAL FARMS.

DESCRIPTIONS OF VARIETIES.

Brighton.—A very vigorous grower, hardy, and very productive. Fruit above medium in size, roundish or slightly conical, bright red; moderately firm; mildly subacid, moderately juicy; quality medium to above medium. Season early. Promising on account of hardiness, earliness, vigour and productiveness.

Count.—A seedling of Biggar's Seedling. A strong grower, hardy and productive. Fruit large, roundish, bright red; moderately firm; briskly subacid, juicy with a pleasant but not high flavour; quality above medium. Season early. One of the most promising for earliness, size of fruit and productiveness.

Craig.—Of unknown parentage. A strong grower, but not quite hardy enough at Ottawa, hence not productive here, although it promises to yield well where hardy. Fruit above medium size, roundish to conical, bright red; drupes large; fairly firm; moderately juicy, mildly subacid; good flavour and of good quality. Season medium.

Deacon.—A strong grower and productive. Fruit medium in size, roundish, rather irregular in shape, deep red; drupes large; soft; subacid, with a good flavour; quality good to very good. Season medium. Not large enough nor firm enough to be especially promising.

Henry.—A strong grower, hardy and productive. Fruit above medium to large, roundish to slightly conical, bright to deep red; moderately firm; briskly subacid, juicy; above medium in quality. Season medium. This variety is hardier than most, and being productive and of good size may be useful.

Lorne.—A strong grower, moderately productive. Fruit above medium to large, conical, deep red; moderately firm to firm; moderately juicy, subacid, pleasant flavour and of good quality. Season medium. Not especially promising.

Mary.—Of unknown parentage. A medium grower and would be a good cropper if hardier, but is not hardy enough for this district. Fruit medium to above medium in size, bright to deep red, roundish or slightly conical; fairly firm; moderately juicy, subacid, good flavour; quality good. Season medium. Might be desirable where hardy enough.

Muriel.—A seedling of Biggar's Seedling. A strong grower and productive. Fruit medium to above medium in size, roundish to slightly conical, bright to deep red; moderately firm; juicy, subacid; quality above medium. Season early. May be useful on account of vigour and productiveness.

Nelson.—A strong grower and moderately productive. Fruit above medium to large, somewhat conical, deep red; firm; moderately juicy, subacid; above medium in quality. Season medium. May be useful on account of firmness. Not quite hardy enough at Ottawa.

Percy.—A strong grower and very productive when not injured by winter, but of late years has proved too tender at Ottawa, and there has been very little fruit. Fruit large, round, deep purple or purplish red; moderately firm, juicy, acid but of pleasant flavour and of good quality. Season medium.

Sarah Raspberry.

Sarah.—Originated by Dr. Wm. Saunders, in London, Ont., from a seedling of Shaffer. A very strong grower, quite hardy, but is only moderately productive. Fruit medium to large size, roundish, purplish red; moderately firm; juicy, rich, sprightly subacid, very good flavour and of very good quality. Season late. One of the most desirable for home use, and on account of its lateness should be grown by everyone as it lengthens the season considerably.

Shinn.—Of doubtful parentage. A strong grower, very hardy, and very productive. Fruit below medium to medium size, roundish, dark purplish red; moderately firm; acid, juicy; quality medium. Season medium. Where hardiness and great productiveness are required regardless of appearance and quality this is one of the most desirable.

Sir John.—Seedling of Biggar's Seedling. A very strong grower and productive. Fruit above medium to large, roundish, bright red; drupes large; rather soft, breaks easily; subacid, pleasant flavour, good quality. Season early. Promising on account of earliness and hardiness, but too soft for general use.

BLACK CAP RASPBERRIES.

DESCRIPTIONS OF VARIETIES.

The Black Cap raspberries are not nearly so hardy as the red raspberries, and as the northern limit of the wild species is not much north of Ottawa, it is not to be wondered at that the cultivated varieties do not do well here.

Between winter-killing and Anthracnose, a disease which the Black Caps are very subject to, the average yields from the varieties of this class of raspberries have been small. A few varieties have proved a little hardier and freer from disease than others. The following descriptions have for the most part been made from fruit grown at the Experimental Farm.

Conrath.—Found by C. H. Woodruff, Ann Arbour, Mich., in 1886. A chance seedling near a plantation of the Gregg. Introduced in the spring of 1894 by Conrath Bros. Has not proved hardy at Ottawa. Said to be a strong grower and producing large black fruit of good quality. Season early. Reported on favourably by A. E. Sherrington, Walkerton, Ont.

Cumberland.—Originated by David Miller, Harrisburg, Pa. Supposed to be a seedling of Gregg. Brought into notice about 1896. A strong grower, hardy and productive. Fruit medium to large, black; firm; juicy, sweet with a good flavour; quality good to very good. Season medium early. One of the hardiest varieties. Promising.

Gregg.—A chance seedling found growing wild on the farm of Messrs. R. & J. Gregg, Aurora, Indiana, in 1866. Came into prominence about 1876. A very strong grower, too tender at Ottawa, but productive when uninjured. Fruit large to very large, roundish, slightly flattened, black with a conspicuous grey bloom; firm; moderately juicy, sweet; good quality. Season late. This is one of the standard late kinds.

Hilborn.—A chance seedling with W. W. Hilborn, Arkona, now Leamington, Ont. Introduced by him in 1886. A strong grower, hardy, and very productive. Fruit medium to large, black with a little bloom; firm; juicy, sweet, good flavour; quality very good. One of the hardiest and best.

Kansas.—A seedling originating with A. H. Griesa, Lawrence, Kansas, in 1884, and introduced in 1890. A moderately vigorous grower. Not hardy enough at Ottawa. Fruit above medium size, glossy black; firm; sweet, good flavour and of good quality. Season medium.

Mills.—Introduced by Charles Mills, Fairmount, N.Y. Said to be a cross between Gregg and Tyler. A strong grower but not quite hardy enough at Ottawa. Productive where it is hardy. Fruit large and black with a fair amount of bloom; firm; moderately juicy; sweet; good quality. Season rather late. A good commercial berry where it is hardy enough.

Ohio.—Found growing among the Doolittle by Hiram Van Dusen, Palmyra, N.Y., nearly forty years ago. A strong grower and productive, where hardy. Fruit medium in size, black; firm, juicy, sweet, very seedy; good quality. Season medium. Not much grown now but was at one time very popular. Esteemed for drying on account of its seediness.

Older.—A chance seedling which originated with Mr. Older, Independence, Iowa, about 1872. Introduced by L. K. Ballard, Warren, Ill., in 1882. A strong, rather pendulous grower, hardier than most and moderately productive. Fruit large, quite black, being without bloom; firm; juicy, sweet; good quality. Season medium early. The Older and Hilborn have done best at Ottawa.

Onondaga.—A cross between Gregg and Tyler, originated by Charles Mills, Fairmount, N.Y., in 1884. A strong grower and productive where hardy, but not quite hardy enough here. Fruit large and black; firm; moderately juicy. Sweet and subacid; good flavour; quality above medium. Season medium late.

Palmer.—Originated with F. R. Palmer, Mansfield, Ohio, and introduced by him in 1888. A strong grower, but not hardy enough at Ottawa. Where hardy it is moderately productive. Fruit of medium size, black, firm; juicy, sweet and subacid, good flavour; good quality. Season early. One of the best early varieties where it is not injured by winter.

Smith Giant.—Originated by A. M. Smith, St. Catharines, Ont. A seedling of either Gregg or Shaffer. First fruited in 1888. A very strong grower, but too tender at Ottawa. Productive where hardy. Fruit large to very large, roundish, black, with a grey bloom; firm; moderately juicy, sweet; good quality. Season late. Much like Gregg, but a little hardier. One of the best late varieties.

Hilborn Raspberry.

THE BLACKBERRY.

It is only about sixty years since the first named variety of blackberry was introduced into America. Up to that time the blackberry had received little attention as a fruit to be cultivated, the two principal reasons for which being probably the prickly nature of the plants, rendering the handling of them unpleasant, and the good quality of the fruit, in the wild condition. Furthermore, there were no cultivated varieties to be introduced from Europe, as little attention has even yet been paid to the native blackberry there.

The first named variety of blackberry introduced into America was the Dorchester, a seedling introduced by E. Thayer, Dorchester, Mass, about 1850. It was first exhibited before the Massachusetts Horticultural Society in 1841. Much of the credit of its general introduction is due, however, to Capt. Josiah Lovett, Beverly, Mass., who, although he had little success himself in obtaining better varieties from seed, was so enthusiastic over the improvement of the blackberry that he did much to forward the culture of this fruit. The next decided advance in the development of the blackberry was when the Lawton was introduced. This variety was a chance seedling found by Lewis A. Seacor, at New Rochelle, N.Y., and brought into notice by Wm. Lawton, of that place, about 1848, and introduced in 1857. It has also been known under the name New Rochelle and Seacor's Mammoth. The introduction of the Kittatinny about 1865, marked another advance. This variety was found at Hope, N.J., and introduced by E. Williams. The introduction of the Snyder marked the advent of the commercial variety. This blackberry, though inferior in size and quality to many others, proved more generally hardy, and being very productive and a good shipper it has become the most popular all-round berry. It was found as a chance seedling by Henry Snyder, near La Porte, Ind., about 1851, but was not brought into general notice until much later. When it is considered that all the varieties mentioned originated as chance seedlings, the possibilities of improvement by selection and cross-breeding are apparent. Some of the newer varieties originated in this way do show a decided improvement in the size and quality of the fruit. What is now needed is greater hardiness.

The blackberry is a native of the Eastern States, and in Canada it is found from Nova Scotia westward and northward to near the Manitoba boundary. What was originally known as one species is now broken up into several, but as nomenclature is still in a transitionary stage it might be confusing to refer to them here. Horticulturally, the blackberries have been divided by Prof. L. H. Bailey into six different groups, namely:—

1. 'The Long Cluster Blackberries,' of which the Taylor and Ancient Briton are examples.
2. 'The Short Cluster Blackberries,' of which the Agawam, Kittatinny and Snyder are examples.
3. 'The Leafy Cluster Blackberries,' to which the old Dorchester and the Early Harvest belong.
4. 'The White Blackberries,' which belong to the long cluster type, but have light coloured fruit.
5. 'The Loose Cluster Blackberries and Dewberry,' to which Rathbun and Wilson's Early belong.
6. 'The Sand Blackberry,' A southern species represented by the Topsy or Child's Tree Blackberry.

The commercial culture of blackberries in Ontario and Quebec is confined mainly to southwestern Ontario. In the Lake Huron district, where there is a heavy fall of snow, blackberries succeed very well, but when unprotected by this covering in winter

they are not satisfactory. They are grown with varying degrees of success in other parts of these provinces, the amount of protection they get in winter usually governing the results obtained. At Ottawa there is rarely a good crop of blackberries, as there is not quite enough snow as a rule to protect them well, and the canes are injured.

PROPAGATION.

The blackberry is one of the easiest fruits propagated. The suckers, which are produced in great numbers, may be used, or if one wishes to propagate a variety even more rapidly than by suckers, it may be increased from root cuttings. The roots are cut up into pieces two or three inches long. They may either be made in the fall or spring, and are then planted about three inches deep in nursery rows for one season, at the close of which if the soil is well cultivated there will be good plants available.

Agawam Blackberry.

SOIL, PLANTING AND CULTURE.

The blackberry ripens its fruit at a trying time of the year as in late July or August there is often hot, dry weather, and if there is not a good supply of moisture in the soil the fruit will dry up, and what has promised a big crop will result in only a few good berries. In choosing a soil, therefore, one should be chosen which will retain moisture well. As the blackberry is inclined to grow late in the fall, and on this account is more tender than the raspberry, soil should be chosen which although rich in plant food has not an excess of nitrogen, which would be liable to induce late growth. Hence bottom land should be avoided in most places as such is likely to be rich in nitrogen.

One of the best soils for blackberries is a good upland clay loam. In such soil there is likely to be sufficient plant food and moisture without an excess of either, making conditions favourable for the development of the crop and the ripening of the wood. The soil should be well prepared as for all other bush fruits and a good application of rotted barnyard manure to most soils will be found desirable.

Spring planting is usually preferable. If planted early in the autumn the young plants are liable to start growth and the new shoots to be injured by the frost, hence if planted in the fall they should be set late. Strong one-year old suckers are the best to plant.

Blackberries require a great deal of space to develop properly and to give an opportunity of cultivating and picking them. The rows should not be less than eight feet apart, with the plants about three feet apart in the rows. The quickest way to plant is to open deep furrows eight feet apart which cross a light mark every three feet. At each intersection of the rows the plant is set a little deeper than it was before and the soil thrown against it and well pressed against the roots. Where the soil is well prepared, planting may be done very quickly by opening a hole with a spade when the soil is lightly marked both ways.

If especially fine fruit is desired a good method of planting is to set the plants about eight feet apart each way and keep them in hills. By this method cultivation may be maintained both ways and the plants having a better opportunity to develop will bear finer fruit.

Good cultivation should be given the first year to get the plants well established and to procure a strong growth early in the season. When the plants are eighteen inches to two feet in height they should be pinched off to make them throw out side shoots and thus keep them better within bounds. All canes except three or four of the strongest should be cut out. The second year the new shoots made that season should be pinched back when between eighteen inches to two feet in height, and as they will not all be the same height at the same time, it is necessary to go over the plantation several times. It is important to do this work in good time, as if done too late the laterals will grow too late and be injured by winter. During the second season five or six of the strongest canes should be left, and all the rest should be removed either during the summer or in the autumn. This practice is then followed every year, the canes which have borne fruit being removed as soon after fruiting as it is convenient to do the work. Each spring the laterals should be headed back considerably, the length of lateral to be left depending on the variety, as some kinds set fruit further out on the laterals than others. Until the fruiting habit of the varieties is known the laterals should not be headed back until the flower buds show. The length of lateral to leave after pruning will vary considerably but there should not be more than two feet left. If it has not been possible to pinch in summer, and no pinching is better than pinching too late, the bushes may be headed back to three or four feet in height in spring, and the laterals headed in as already described.

The conservation of moisture is very important in growing blackberries, and as the fruit does not ripen until late in the summer, cultivation will be later than for most fruits. It will be usually found best to continue cultivating until the berries are almost ready to pick.

A blackberry, when it is perfectly ripe, is one of the finest fruits, but if picked before it is ripe it is quite unfit to use. Unfortunately, some varieties become black before they are fully ripe and are picked too soon, and frequently blackberries are picked before they are well coloured, the result being that they reach the market in an unripe condition, and it is not to be wondered at that those who try them in this condition do not wish to use blackberries again. It would be in the best interests of their business if fruit growers would pay more attention to this matter, and only ship fruit which will be in good condition when it reaches the consumer.

The pinching back in summer tends to keep the bushes lower than they otherwise would be, and they are thus more protected in winter, but they may be still more protected by bending them over and covering the tips with soil to hold them in place,

although this is very unpleasant work, and it scarcely pays to do it if blackberries are grown for sale.

A blackberry plantation is in full bearing the third season after planting, and will continue profitable for a long time if well cared for, but it is usually best to renew the plantation every eight or ten years.

YIELDS OF BLACKBERRIES.

The blackberry is a more uncertain cropper than the currant, gooseberry and rasp berry, as it suffers more in winter and is affected more by dry weather in summer. No really good crops of blackberries have been produced at Ottawa, the best yield being in 1895, when the Agawam yielded at the rate of 2,452 boxes per acre. The next best yield was in 1903, when the Agawam yielded at the rate of 1,979 boxes per acre.

Bailey, in his Horticulturist's Rule Book, gives the yield at from 50 to 100 bushels per acre, which at 32 lbs. to a bushel is from 1,600 to 3,200 lbs.

VARIETIES OF BLACKBERRIES RECOMMENDED.

Agawam, Snyder, Eldorado, and for southern sections, Kittatinny.

DESCRIPTIONS OF VARIETIES.

Agawam.—A chance seedling found growing wild by John Perkins, Ipswich, Mass., between 1865 and 1870. A strong to very strong grower, hardy, and productive. Fruit medium to large, oblong to long, glossy black; firm; juicy, sweet; of good quality. Season medium early. This variety has proved the hardiest and most productive at Ottawa.

Ancient Briton.—Supposed to have been brought out from England nearly fifty years ago. Named by Robert Hassell, Alderly, Wis. A strong grower and productive where hardy. Not as hardy as Agawam and Snyder. Fruit medium to above medium size, oblong, black; firm; sweet; good quality. Season medium early. Resembles Agawam somewhat, but not as good.

Eldorado.—A chance seedling found near Eldorado, Ohio, and introduced about 1882. A strong grower, hardy and moderately productive. Fruit medium to large, roundish to oblong; black, attractive; firm; sweet, juicy; good flavour; good quality. Season medium early. One of the hardiest of the newer varieties.

Kittatinny.—Found at New Hope, N.J., and introduced by E. Williams about 1865. A moderately strong grower and productive if not injured by winter, but as it is one of the tenderest kinds it is liable to suffer. Fruit large to very large, roundish or oblong, glossy black, attractive; moderately firm; juicy, sweet, of good flavour; quality good to very good; season moderately late. One of the best varieties where it can be grown, but is only suited to the warmest parts of Canada.

Mersereau.—Originated with J. W. Mersereau, Cayuga, N.Y. Said to be a seedling of Snyder. Has not been sufficiently tested here yet. Fruit above medium to large, roundish to oblong and of an attractive glossy black colour; juicy, sweet and subacid, sprightly. A promising variety but not as hardy as Agawam and Snyder.

Rathbun.—Introduced by A. F. Rathbun, Smith's Mills, N.Y. A moderately strong grower. Too tender here. This is a large fruited variety of good colour and quality, but has not fruited here. It is too tender for any but the warmest parts of Canada.

Snyder.—A seedling found growing wild on or near the farm of Henry Snyder, La Porte, Ind., about 1851. A vigorous grower and one of the hardiest varieties. Productive. Fruit medium in size, roundish, black, but sometimes with a reddish tinge if exposed; firm; juicy, sweet; good quality. Season medium early. This variety is probably more grown than any other on account of its hardiness, but

Agawam has averaged much better as regards yield at the Central Experimental Farm during the past sixteen years.

Wachusett (Thornless).—The only merit of this variety is its comparative freedom from spines. Not productive and of small size. Not desirable.

Western Triumph.—A chance seedling found on the prairie by Mr. Biddle, Muskegon, Ill., in 1858. A strong grower and very productive where hardy. Not hardy enough here. Fruit medium to large, roundish to oblong, black; firm; juicy; sweet; good quality. Season medium. Is spoken highly of by Mr. A. W. Peart, of the Burlington Fruit Experiment Station.

Snyder Blackberry.

THE DEWBERRY.

The dewberry is closely related botanically to the blackberry, the most apparent differences being in the trailing habit of the former and its smaller flower clusters. The fruit of the dewberry is equal in quality to that of the best blackberries. Most of the varieties of the dewberry are from the wild species, *Rubus canadensis,* and its varieties. They have only been grown extensively under cultivation within the last twenty years.

The dewberry is propagated from the tips, which root readily when they come in contact with the soil.

This fruit is cultivated much the same as the blackberry. The plants are set about four feet apart each way and tied to stakes about three feet above ground, or trained on a trellis. If trained on a trellis the rows should be about six feet apart with the plants about three feet apart in the rows.

The following method of training, which seems a good one, is recommended by W. F. Allen, Salisbury, Md.:—

'Our plan of cultivation is to plant in rows each way, two and one-half feet one way and five feet the other way, making about 3,500 plants per acre. Cultivate both ways until plants get long and troublesome and then cultivate only the wide way and turn vines to keep the cultivator from tearing them; or better yet use sweeps on your cultivator. These will run under the vines and weed up the grass without disturbing them. Leave vines lying on the ground till all danger of winter killing is over, and then early in the spring, before buds put out, stakes should be driven between each alternate hill the two and one-half foot way. The stakes should be two and one-half or three feet above the ground and one hill from each way tied to the top of the stake.' Binder twine is used for tying.

The dewberry is not pruned in summer as the blackberry, the canes being simply pruned back in spring, if too long, and thinned out to four or five strong canes in a hill. The young growth falls to the ground in summer and the tips take root. Sometimes the dewberries do not fruit well owing to poor pollination, and it is recommended to plant more than one variety on this account. There are varieties which are particularly self-sterile when planted alone.

The dewberry has not done well at Ottawa, but this fruit has not been given very much attention here. Most of the varieties of this fruit ripen just before the earliest blackberries, and owing to their tender or melting core are much liked. The two most popular varieties are:—

Lucretia.—Fruit large, oblong, glossy black; juicy, sweet, and of good quality. Season early.

Mayes (Austin Improved).—Fruit very large, oval to somewhat conical, glossy black; juicy and of good quality. Season very early. Earlier than Lucretia.

DISEASES OF THE RASPBERRY AND BLACKBERRY.

ANTHRACNOSE or RASPBERRY CANE RUST (*Glœosporium venetum*).—Anthracnose has seriously injured raspberries in many parts of Canada during recent years. So serious is the injury in some places, and so difficult is it to eradicate that growers have become discouraged and have given up the culture of this fruit. This disease first makes its appearance when the young shoots are from twelve to fifteen inches in length, and is recognized by the brownish or purplish patches or depressions upon the young shoots and leaf stalks. As the shoots grow, the blotches become larger and greyish in the centre, and by the end of the season may encircle the cane and practically girdle it. The plant suffers most during the second season when the disease has usually spread so much that a large proportion of the canes and smaller stems are affected and moisture is cut off from the fruit, thus preventing its proper development and often causing the cane to die. This disease reproduces itself by spores in summer which are scattered by wind and rain. The disease is supposed to pass through the winter by means of the mycelium of the fungus in the intercellular spaces of the cane.

Poor success usually attends any attempt to control this disease by spraying, although some experimenters claim to have obtained good results. The best results have been obtained from spraying by beginning with Bordeaux mixture before the leaves open in the spring, giving a second spraying soon after the young canes appear above ground, the young canes being thoroughly covered with the mixture. A third spraying is made about two weeks after the second, paying special attention to the young canes. A fourth spraying should be made just before blooming.

Fruiting canes should be cut out and burned immediately after fruiting. Healthy plants should, if possible, be obtained from another source when making a new plantation, and these planted on different soil.

Anthracnose is usually worse in neglected plantations, hence raspberries should be well cared for and the canes kept thin in the rows, as if there is a good circulation of air there is less likely to be injury from this disease.

ORANGE RUST (*Gymnoconia interstitialis*, syns. *Puccinia peckiana* and *Cœoma nitens*).—The Orange Rust affects both raspberries and blackberries, but particularly the latter. It has two forms which at one time were thought to be two distinct species. When the plant is affected the leaves become pale green or yellowish as soon as open in the spring, and in a short time the surface of the leaf becomes covered more or less with small, round patches indicating the orange coloured spores which give the name Orange Rust to this disease. In addition to infecting the leaves, the spores after falling to the ground germinate and the mycelium enters the roots of the plants, re-infecting them. From the roots it spreads to the branches and produces summer and winter spores which are not so apparent as those produced in spring. As the mycelium continues to live in the plant without re-infection, it is very difficult to control this disease. All diseased plants should be dug out and burned. Spraying is not sufficiently effectual.

RASPBERRY CANE BLIGHT (*Coniothyrium* sp.).—This is a disease identified by the New York Experiment Station, which causes much injury to raspberries in that State, and doubtless is often mistaken for Anthracnose in Canada. This disease causes the leaves to wilt and the canes to die, when the fruit is ripening. The cane blight disease attacks the cane at some point and destroying the living tissue prevents the sap from flowing and the parts above the diseased part die. It attacks both the red and the black cap raspberry. Frequently only one branch of a cane is affected. The disease is made apparent by the discolouration of the wood, which may show on one side of the branch at first and finally encircle it. Diseased wood is lighter coloured and smoky looking. The diseased patches may occur at several places along the cane with healthy

parts between. Sometimes small pimples are seen from which the spores ooze out. These pustules are, however, just under the bark as a rule. By cutting into the cane the diseased wood will be found to be much discoloured. The cane is also very brittle at the diseased parts. Fruiting canes may die in the spring or in the summer, but the disease is worse when the fruit is ripening. The spores are produced in summer and infection usually takes place at that time. Spraying has not been found successful in combating this disease, which must be treated as Anthracnose, only healthy plants being used in planting, and the diseased canes kept cut out and burned.

RASPBERRY YELLOWS.—This is another disease which has been given especial study at the New York Experiment Station. Raspberries attacked by this disease are stunted and the leaves have a yellowish and mottled appearance. The fruit does not all mature and that which does is dry and insipid. The young growth is not usually checked, but the leaves are sometimes affected. Spraying has had no effect on this disease. The Marlboro raspberry appears to be more injured by Yellows than most other varieties.

LEAF SPOT (*Septoria rubi*).—This disease sometimes affects the leaves of raspberries and blackberries. It appears in purplish spots on the leaves. These spots become eventually lighter coloured at the centre, and small black pimples are found there. These produce spores which are spread by wind and rain. This disease can be controlled by spraying with Bordeaux mixture.

INSECTS INJURIOUS TO RASPBERRIES AND BLACKBERRIES.

(By JAMES FLETCHER, *Dominion Entomologist.*)

BLACKBERRY SOFT-SCALE (*Lecanium fitchii,* Sign.).—At rare intervals whole plantations of blackberries are found to be suddenly covered with a large dark brown soft scale. These may be so abundant as almost to cover the whole of the stems from top to bottom. The separate scales, when at their largest size, in June, are nearly hemispherical, somewhat smaller at the base, where they are attached to the bark, and measure nearly ⅛ of an inch across. These insects, as a rule, occur in these vast numbers only in old plantations, where the bushes have been left undisturbed for several years. The effect upon the plants is naturally very weakening, and, although this scale is as a rule very heavily infested by parasitic enemies belonging to the Chalcididæ, and by several species of lady-bird beetles, there are many instances where great injury has been done.

Remedy.—This scale insect, like others of the same family, passes the winter in a partially grown condition on the stems of the blackberries. The pruning away of all unnecessary wood, and a thorough spraying with kerosene emulsion in spring before growth begins, will control this enemy in plantations which it is desired to preserve; but where possible a new plantation should be set out in good rich well worked land.

RASPBERRY CANE-BORER (*Oberea bimaculata,* Oliv.).—During the month of June the young and vigorous shoots of raspberries may sometimes be noticed with their tips fading and bent down. This is generally an indication that the stem has been girdled by the female beetle which is the parent of the cane-borer. This beetle is slender in shape with black wing covers and a yellow thorax which usually bears three black spots above. After pairing, the female flies to a young shoot of the raspberry or blackberry, and with her mandibles cuts two rings of punctures around it. These rings are separated from each other by about an inch or less. In between the rings she pierces the cane and forces into it a long yellow egg. Immediately after this girdling, the tip of the shoot fades and soon dies. A few days after being laid, the egg hatches and the young larva burrows down the centre of the stem, consuming the pith. It becomes full-grown about the end of August, but remains in the cane throughout the winter,

and changes to a pupa the next spring. The beetles escape from their burrows in June, when they may be found on the bushes.

Remedy.—The Raspberry Cane-borer is far commoner among wild raspberries than in cultivated plantations. The indications that eggs have been laid, are so conspicuous that they can be detected with great ease during the hot days of June. As soon as a faded shoot is noticed, it should be broken off below the lower ring, or, what is safer, the cane may be cut off well below the injury, so that there is no danger of leaving the grubs which may have hatched before the injury is noticed.

Raspberry-cane Maggot (*Phorbia rubivora*, Coq.).—A similar injury to that of the Raspberry Cane-borer is done by the Raspberry-cane Maggot, except that the female does not produce the two rings of punctures. The egg is laid by a small black fly, which resembles a house fly in shape, but is much smaller, in the axil of one of the upper leaves. The young maggot bores down the stem until full-grown and then changes to a brown puparium inside the stem. The same remedy is applicable for both of these insects, but the Raspberry-cane Maggot burrows further down the stem before the indications of its presence are made apparent by the fading of the shoot.

Raspberry Flower-beetle (*Byturus unicolor*, Say).—When raspberries are in bud or the flowers are opening, small silky pale-brown beetles about ⅛ of an inch long, may be found, sometimes in large numbers, eating into the flowers and doing much harm by destroying the essential organs. This little beetle, which belongs to the destructive Dermestidæ, not only eats the flowers, but lays its eggs in them. The grubs are whitish and, although they do not cause very serious loss to the fruit, may be found beneath the pulp, either at the base or around the core.

Remedy.—In years when this beetle is abundant, it seems almost impossible to protect a crop of raspberries from their depredations, the buds and flowers of a whole bush being sometimes destroyed. Collecting the beetles by hand by beating them into a net or open pan of water with coal oil on the top will destroy large numbers, but this must be repeated morning and evening throughout the time the raspberries and early blackberries are in flower. As in the case of the Raspberry Cane-borer, the wild raspberries, fortunately, seem more attractive to the beetles than the cultivated varieties.

Raspberry Negro Bug (*Corimelæna pulicaria*, Germ.).—The nauseous, buggy odour and taste of the small black bug, which sometimes causes these unpleasant accompaniments of a delicious raspberry, are unfortunately well known to most people who do not examine that fruit carefully before putting it into their mouths. The bugs are seldom found upon fruit which is picked and carried to the market; but, when eating fruit from the bush, it is well to examine carefully if any of the small black beetle-like bugs, less than ⅛ of an inch in length, are present. They also attack blackberries as well as raspberries.

Red-necked Agrilus (*Agrilus ruficollis*, Fab.).—When raspberry and blackberry canes are being pruned, there may sometimes be seen rough swellings of an inch or more in length. These are the 'Gouty gall' of the raspberry and blackberry, and each of them contains the slender larva of a Buprestian beetle. Each gall contains one slender grub with a flattened head, but there may be several galls on the same cane. The eggs are laid in July, and the young larvæ eat their way into the soft shoot and burrow an irregular spiral channel around the cane, causing much injury and weakening its growth. They remain as larvæ until the following summer. The Red-necked Agrilus is a rather uncommon enemy of the raspberry in Canada, and, although it is more abundant on blackberries, it is not a regular enemy of the fruit grower, nor is it very injurious.

Remedy.—The only remedy for this insect is to cut out all galled canes early in spring and burn them. No stem bearing a gall ripens a good crop of berries; so they are far better removed, even if less wood is left than is desired.

RASPBERRY ROOT-BORER (*Bembecia marginata*, Har.).—The roots and stems of raspberries and blackberries, particularly in old plantations, are sometimes injured by a dirty-whitish caterpillar with a red head, nearly an inch long, that bores in the root and base of the stem. It passes the winter as a caterpillar and then bores up five or six inches into one of the canes and changes to a chrysalis. The perfect female insect of this borer is a black clear-winged moth with a body striped with yellow, and both in appearance and movements looks much like a wasp. She lays her eggs on the leaves of raspberries and blackberries in July and sometimes well on into August. The attacks of these caterpillars at the roots cause many raspberry canes to die which are thought to have been winter-killed.

Remedy.—When this insect gets introduced into a plantation it is difficult to eradicate. The chief means of lessening attack is to start new plantations in good soil and keep these well worked and cultivated. When the larvæ are discovered in the roots, they may be dug out without much trouble, as the burrows are large. A piece of bent wire is useful for this purpose; but such a remedy is only advisable in the case of special bushes which it is desired to preserve.

RASPBERRY SAWFLY (*Monophadnoides rubi*, Harr.).—During June, and about the time raspberries are in flower, the leaves may sometimes be noticed to be riddled with small holes. On examination, this will be found to be the work of small green bristly false-caterpillars about ½ an inch in length. They are rather hard to see on account of their colour, but their work is easily recognized. There is only one brood of this insect in the year; the flies are black with a dull reddish blotch in the middle of the abdomen above. They are about the size of the house fly but narrower in shape and have four wings. The eggs are inserted into the tissues of the leaf from the lower side and a small brown patch appears on the leaf above each egg. The eggs hatch after about a week. The larvæ are full-grown by July, when they fall to the ground and spin small cocoons beneath the surface of the soil.

Remedy.—As in the case of all sawfly larvæ, white hellebore either dusted over the plants, or steeped, one ounce in two gallons of water, and sprayed over the foliage, is a sufficient remedy. A very weak solution of Paris green, one ounce in twelve gallons of water, is cheaper and more effective; but this must not be used after the fruit is formed.

RED SPIDER.—See under Insects Injurious to Currants, &c.

SIX-SPOTTED PARIA (*Paria sex-notata*, Say).—Serious injury is sometimes done to raspberries by small shining brown beetles ⅛ of an inch in length, varying much in colour and markings, but, in the commonest form found on raspberries, having honey-yellow wing-cases each bearing two large black blotches, the thorax reddish brown, and the legs yellow. With these are sometimes also found some specimens which are entirely black. The injury is done early in the season, just as the raspberry leaf-buds are bursting, and occasionally every bud may be eaten from a plant or from a large patch in a plantation. These beetles are rather sluggish in habit, but fly readily from place to place. The larval state is passed in the ground, where the insect feeds on the roots of the strawberry and also probably on those of the raspberry.

Remedy.—The injury takes place during the month of May, when there is very little surface on the canes to hold a poisonous application. The only effective method of preventing injury by the beetles is to use a strong arsenical wash by which the leaf-buds may be completely covered. For this purpose Paris green, one ounce in ten gallons of water, to which lime was added in the proportion of two or three pounds to each ten gallons, gave the best results. This insect, like the Rose Chafer, appears to be far less susceptible to strong poisons than most leaf-eating insects. Sometimes the beetles do not appear until the raspberries have made considerable growth, and in such cases many of them may be destroyed by beating into nets or open pans containing water and coal oil.

SNOWY TREE-CRICKET (*Œcanthus niveus,* Serv.).—When raspberries are being pruned, all canes bearing the long scar, sometimes three inches in length, which contains the eggs of the Snowy Tree-cricket, should be cut out. This insect seems to have great preference for certain plantations, and the injuries to the canes in such places are sometimes serious. The eggs are forced into the pith of the cane, thus weakening it and reducing the crop. The young tree-crickets hatch early in summer and feed all their lives upon plant lice and other small insects. The only injury, therefore, by these insects is from the abundance of the wounds made by the females when laying their eggs.

Remedy.—Trimming out and burning during fall or winter, all canes containing the eggs, is the only practical remedy.

In addition to the above, there are certain other insects the attacks of which upon raspberries and blackberries are of less importance, but which, of course, may at any time assume more serious proportions. Among these are the caterpillars of various noctuid moths known as cutworms, which crawl up the stems at night and attack the foliage. Among these is the Black Army worm (*Noctua fennica,* Tausch.), and some caterpillars of similar habits. These may all be controlled when their depredations are recognized, by distributing poisoned bran mash beneath the bushes. Several kinds of gall-making insects do a certain amount of injury, and these must be reduced in numbers, when unduly abundant, by pruning out the galls or by good methods of cultivation, such as setting out new beds and not keeping any land too long under the same crop. The larvæ of several small moths feed more or less on the foliage, such as the Raspberry Plume Moth (*Oxyptilus tenuidactylus,* Fitch), the Oblique-banded Leaf-roller, &c. These may all be kept in check by spraying the bushes either with a decoction of hellebore, or a weak mixture of Paris green and water.

The Entomologist will at all times be pleased to help fruit growers with advice as to the identification of, or the best remedies to apply for the attacks of, any insects they may find injuring their crops. He will also be exceedingly grateful for information as to the appearance in large numbers of any fruit enemies, whether of well known insects or not. Specimens of all kinds, within the limits of the postal regulations, can be sent FREE by mail if addressed to The Entomologist, Central Experimental Farm, Ottawa.

HISTORICAL SKETCH OF THE WORK OF DR. WM. SAUNDERS, DIRECTOR OF THE DOMINION EXPERIMENTAL FARMS, IN IMPROVING THE CURRANT, GOOSEBERRY AND RASPBERRY.

In this bulletin, 45 of the varieties of bush fruits described were originated by Dr. Wm. Saunders, Director of the Dominion Experimental Farms. The following historical sketch of the origin of these fruits is published, in order that this good work may be better known and in order to bring together as much information as possible regarding these fruits. This is part of a paper prepared by Dr. Saunders and read before the Botanical Section of the British Association for the Advancement of Science, at Toronto, Ont., August, 1897. The paper is published in full in the Annual Report of the Dominion Experimental Farms for 1897.

THE GOOSEBERRY AND CURRANT.

The first *crosses attempted in 1868 were with the gooseberry. These were made with the object of improving the size and quality of what are known as the American gooseberries, by introducing strains of some of the best English sorts, and at the same time to obtain varieties free from the gooseberry mildew, *Sphærotheca mors-uvæ*, which has in the past affected nearly all the English gooseberries grown here, so badly both in foliage and fruit as to discourage their cultivation. Those which are known as American or native sorts are believed to have resulted from crosses between the wild species and European forms, and are noted for their hardiness, productiveness, and freedom from mildew. Several hundred seedlings resulted from these efforts, some of which are still in cultivation. Two of them—one named Pearl (a cross between Downing and Ashton's Seedling, or Broom Girl) and Red Jacket (a cross between Houghton and Warrington)—are both popular sorts, on account of their size, productiveness and freedom from mildew, and are now extensively grown both in Canada and the United States. Among the early experiments some trials were made with the wild sorts—the small, smooth gooseberry, *Ribes oxyacanthoides*, and the prickly gooseberry, *Ribes Cynosbati*. No success attended the efforts with the former; but among the crosses obtained on the prickly gooseberry, *R. Cynosbati*, with Warrington were several interesting sorts, one of which was quite smooth, another sparingly hairy, and a third somewhat more hairy. This latter is still under cultivation at the Central Experimental Farm at Ottawa. In growth and habit the bushes resemble the female parent, but the fruit is considerably larger and much improved in quality, and the berries when ripe are tinged with red. Efforts were also made during these early years to cross the black, red, and white currants with the gooseberry, but without success. After five or six years the new seedlings had increased to such an extent that their number was embarrassing, and no more work was undertaken on this line until 1890, after the establishment of the Canadian Experimental Farms, when a larger field for such work was opened. On my arrival from London, Ontario, at Ottawa, in 1887, all the surviving seedlings of all sorts of any promise—more than 800 in all—were taken to the Central Experimental Farm, and since then, with the help of assistants, many new forms have been produced. Among others, hybrids have been obtained between the cultivated black currant, *Ribes nigrum*, and a cultivated variety of the gooseberry, *Ribes Grossularia;* also between the black currant and white currant, a variety of *Ribes rubrum*. In each instance the black currant was chosen as the female. Three of the

*The term 'cross-bred' is used when referring to crosses produced between different varieties of the same species, and the word 'hybrid,' when referring to forms produced by crossing plants which are recognized as distinct species.

hybrids between the black currant and the white currant, and twenty-eight of those between the black currant and gooseberry, are still under trial. There are in this instance some well marked points of difference between the female and the male, and the hybrids, in many respects, are intermediate in their character. The branches of the black currant are without thorns, whereas those of the gooseberry are thorny; the hybrids have the branches thornless as in the female.

The leaves of the black currant are large, three lobed, with the points of intersection between the lobes slightly notched, and the margins are serrated; the teeth coarse, somewhat irregular and pointed. The leaves are also supplied with a large number of oil cells, so that when bruised they exhale a strong and characteristic odour. The leaf stalks are very slightly hairy towards the base.

In the gooseberry the points of intersection between the lobes of the leaves are deeply notched, and the marginal serrations are more irregular and rounded, with short, blunt points. The leaves when bruised are odourless, and the leaf stalks are shorter and more decidedly hairy with the hairs extending further up the stalk.

In the hybrids the leaves are intermediate in form, and almost as deeply cleft at the junction of the lobes as are those of the gooseberry. The serrations are also of an intermediate character, being less pointed than in the black currant and less rounded than in the gooseberry. The leaves of most of the hybrids have no odour when bruised, except in two instances where the black currant odour is faintly perceptible. The leaf stalks are more hairy than those of the black currant, but less hairy than those of the gooseberry.

The flowers of the black currant are borne on long bunches of seven to twelve, whereas in the gooseberry they are usually in pairs and occasionally there are three in a cluster. In the hybrids they are borne in clusters of from four to seven. In the structure of the pistil of the flower there is also a notable difference. In the black currant the pistil is single, smooth throughout, and somewhat thickened and robust towards the tip, which is flat and blunt. In the gooseberry it is longer and divided to the base, both branches being slender and very hairy for nearly half their length, the slender divisions diverging towards the tip. In the hybrids the pistil is single for about half its length or more, but divided towards the tip, and the divisions divergent. There are also differences in the time of blooming. The flowers of the gooseberry are open some days before those of the black currant; while those of the hybrids are intermediate in that respect.

All the hybrids have flowered freely every season for several years past, and although no imperfection can be detected in the floral organs, no fruit could be found on any of them until last year, when two berries were found on one bush and one on another. These were borne singly, like the gooseberry, and were about the size of a large currant, but of a dull reddish colour. The seeds these contained were carefully saved and sown, but none of them germinated. This season only one specimen of fruit was found and this dropped before it was fully matured. With the view of inducing the fruit to set more freely, clusters of the flowers have been artificially fertilized with pollen from adjacent flowers on the same bush, also from flowers of the black currant and the gooseberry; but none of these experiments have been successful.

The several differences and resemblances noticed seem to establish the true hybrid character of the progeny, a point further confirmed by the fact that the gooseberry and white currant characteristics in these hybrids are recognized by insects and parasitic plants. The gooseberry saw-fly (*Pteronus ribesii*), which is not known to touch the foliage of the black currant, consumes, with great avidity, the leaves of the gooseberry and white currant; it also feeds freely on the hybrids, which, although raised from seed of the black currant, are thus recognized by this insect as partaking of the nature of the male parent. The gooseberry mildew, also *Sphærotheca mors-uvæ*, B. & C., which is not known to affect the black currant, attacks the hybrids freely, showing that the gooseberry characteristics which they possess are recognized also by this fungus enemy of the gooseberry.

Another group of experiments with shrubs in this genus has been the crossing of the cultivated black currant, *Ribes nigrum*, with the wild black currant of the western plains, *Ribes floridum*. From this cross a number of seedlings have been produced, partaking more or less of the characteristics of both parents, some of which promise to be worthy of cultivation for their fruit. During the past season a number of additional crosses in this genus have been successfully made, from which some further results of interest are looked for.

THE RASPBERRY AND BLACKBERRY.

The first crosses were made with raspberries in 1869, and the work has been continued at intervals up to the present time. In 1869 a red variety, known as the Philadelphia, a form of *Rubus strigosus*, which was very productive but lacking in flavour, was crossed with a high-flavoured yellow sort known as Brinckle's Orange, but the progeny in this case was tender and unhealthy in character and none of them have survived. In 1870 a cultivated form of the black cap raspberry, *Rubus occidentalis*, was fertilized with pollen of the Philadelphia. This latter experiment was undertaken mainly for the purpose of gaining some information as to the influence of sex on the character and habit of the offspring. The black raspberry, *Rubus occidentalis*, which was chosen as the female, propagates by rooting from the pendulous tips of the branches, which, late in the season, touch the ground; while the male, the red raspberry, *Rubus strigosus*, sends up suckers from the buds developed on the roots, and these roots extend under the surface to a considerable distance from the base. Twenty-four plants were raised from this cross, all of which fruited in 1873, and some of them were very prolific. In every instance the seedlings rooted from the tips, but not freely, and in two or three instances an occasional sucker was thrown up from the roots, a few inches from the crown. Subsequently these plants were propagated more freely by layering in spring the canes, the growth of the previous summer, when they rooted at almost every joint. The fruit of the best of these hybrids was larger than that of either of the parents; it was intermediate in colour, being dark purple with a whitish bloom, while the flavour was a striking combination of the characteristics of both.

During the following four or five years many additional crosses were made with raspberries, and many attempts were made to cross the raspberry *Rubus strigosus* with the blackberry *Rubus villosus*, but without much success. Most of the efforts failed, but seeds were produced on several occasions. Sometimes these did not germinate, and several times, when one or two seeds did start, the young plants were weakly and died before much growth was made.

SPRAYING FORMULÆ.

INSECTICIDES.

PARIS GREEN.

FOR FOLIAGE-EATING INSECTS.

Paris green	4 oz.
Unslaked lime	4 oz.
Water	40 gallons.

Make the Paris green into a paste with a little water; then stir into the larger quantity of water to which has been added the lime. Apply in a fine spray.

Dry mixture.—1 lb. Paris green with 50 lbs. flour, land plaster, slaked lime or any other perfectly dry powder. Dust the bushes well with this.

Poisoned bran.—Mix ½ lb. of Paris green with 50 lbs. of slightly moistened bran.

HELLEBORE.

White hellebore	1 oz.
Water	2 gallons.

Or the dry hellebore to be dusted undiluted over attacked plants.

PYRETHRUM (OR INSECT POWDER).

Pyrethrum powder	1 oz.
Water	3 gallons.

Dry mixture.—Mix thoroughly 1 part by weight of insect powder with 4 parts by weight of cheap flour, and keep in a close vessel for 24 hours before dusting over plants attacked.

KEROSENE EMULSION.

FOR BARK-LICE AND OTHER SUCKING INSECTS.

Kerosene (coal oil)	2 gallons.
Rain water	1 gallon.
Soap	½ lb.

Dissolve soap in water by boiling; take from fire, and, while hot, turn in kerosene and churn briskly for 5 minutes. For use dilute with 9 parts of water so that the above 3 gallons of stock emulsion will make 30 gallons of spraying mixture.

WHALE-OIL SOAP.

For brown or black aphis	1 lb. in 4 gallons water.
For scale-insects (young)	1 lb. in 5 " "
For green aphis or thrip	1 lb. in 6 " "
For San José scale (in winter)	2 lbs. in 1 gallon "

TOBACCO AND SOAP WASH.

Soak in half a barrel of hot water for a few hours 10 lbs. of tobacco leaves (home-grown will do); strain off and add 2 lbs. of Whale-oil soap. Stir until it is dissolved, and dilute to 40 gals. Apply early and two or three times at short intervals.

LIME WASH.

Unslaked lime	1 to 2 lbs.
Water	1 gallon.

Strain through sacking before spraying.

LIME-SULPHUR WASH.

FOR SAN JOSÉ SCALE AND FUNGOUS DISEASES.

Lime	12 lbs.
Sulphur, powdered	12 lbs.
Water to make	40 gallons.

Slake the lime with only enough water to do it thoroughly. Add the sulphur by dusting it over the lime while slaking; stir well and boil for at least an hour, adding only so much hot water as is necessary for easy stirring. When thoroughly cooked, strain through sacking, and apply hot.

LIME-SULPHUR-SODA WASH.

Lime	25 lbs.
Sulphur, powdered	12½ lbs.
Caustic soda	5 lbs.
Water to make	40 gallons.

Put the lime in a barrel; add enough hot water to make it boil rapidly; while slaking, stir in the sulphur, previously made into a thin paste with hot water; then add the caustic soda dissolved in hot water. Add more water as required to prevent boiling over, and stir briskly all the time. When all bubbling ceases, add hot water to make up to 40 gallons.

Cook sulphur washes in iron pots or by steam in wooden vats or barrels; never use copper vessels either for cooking or for spraying sulphur washes from.

FUNGICIDES:

BORDEAUX MIXTURE.

FOR FUNGI.

Copper sulphate (bluestone)	4 lbs.
Unslaked lime	4 lbs.
Water (1 barrel)	40 gallons.

Dissolve the copper sulphate (by suspending it in a coarse cotton bag in a wooden or earthen vessel containing 4 or 5 or more gallons of water. It will slake more

quickly in hot water). Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place; half fill the barrel with water; dilute the slaked lime to half a barrel of water, and pour into the diluted copper sulphate solution, then stir thoroughly. It is then ready for use. (Never mix concentrated milk of lime and copper solution.)

A stock solution of copper sulphate and milk of lime may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of copper sulphate, lime and water contained in each should be carefully noted.

To test Bordeaux mixture, let a drop of ferrocyanide of potassium solution fall into the mixture when ready. If the mixture turns reddish brown, add more milk of lime until no change takes place.

POISONED BORDEAUX MIXTURE.

FOR FUNGI AND LEAF-EATING INSECTS.

To the 40 gallons of Bordeaux mixture prepared as above, add 4 ounces of Paris green.

AMMONIACAL COPPER CARBONATE.

Copper carbonate	5 oz.
Ammonia	2 quarts.
Water (1 barrel)	40 gallons.

Dissolve the copper carbonate in the ammonia. The ammonia and concentrated solution should be kept in glass or stone jars, tightly corked. It is ready for use as soon as diluted with the 40 gallons water. To be used when Bordeaux cannot be applied on account of staining the fruit.

POTASSIUM SULPHIDE.

(LIVER OF SULPHUR.)

Potassium sulphide	1 oz.
Hot water	2 gallons.

Dissolve the potassium sulphide in hot water.

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

QUALITY IN WHEAT

PART I

BY

CHAS. E. SALMONSEN, Ph. D.,

Chemist.

PART II

BY

FRANK T. SHUTT, M.A.,

Chemist of the Dominion Experimental Farms.

BULLETIN No. 67

OCTOBER, [illegible]

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

QUALITY IN WHEAT

PART I

BY

CHAS. E. SAUNDERS, Ph. D.,
Cerealist.

PART II

BY

FRANK T. SHUTT, M. A.,
Chemist of the Dominion Experimental Farms.

BULLETIN No. 57

OCTOBER, 1907.

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa.

To the Honourable
The Minister of Agriculture.

SIR,—I have the honour to submit for your approval Bulletin 57 of the Experimental Farm series, on Quality in Wheat. It consists of two parts. Part I. has been prepared by the Cerealist, Dr. C. E. Saunders, and Part II., by the Chemist of the Experimental Farms, Mr. Frank T. Shutt.

In Part I. the chief subjects discussed are the breeding of new sorts of wheat of high quality, especially early ripening varieties, suitable for the northern parts of Canada and the determination of the quality of the different sorts now in cultivation with special reference to their relative value in bread-making. The crossing and the selecting of wheats are dealt with, also the methods of milling the different sorts and of conducting baking tests from the samples so obtained. In the baking the proportion of water taken up and retained by the several varieties is recorded. Accurate measurements have been obtained of the volume of the loaves of bread made and the texture, colour and other peculiarities of each sample noted. A method has been devised for estimating the baking strength of each flour from a baker's standpoint, and the relative value of the different flours for the making of bread ascertained. These tests include spring wheats, winter wheats, durum wheats, also several commercial flours, the latter being introduced for comparison. The relative points of merit also the deficiencies found in the different sorts are fully discussed, and the value of mixed flours in bread making considered. The results here presented of the research work carried on by the Cerealist in this important line of investigation are highly interesting, and the methods devised for solving some of the difficult problems encountered are ingenious and original.

In Part II. the chemical aspects of this work are presented, the chemical composition of wheats is discussed and the value of their different characteristics referred to. Most of the samples which have been milled and baked by the Cerealist have been submitted to analysis by the Chemist and much information is thus given as to their composition. The important part played by the nitrogen compounds in the making of bread is also dwelt on, and the total percentages of albuminoids in each sample given, also the proportions of gliadin, sugar and ash found in each case. This bulletin is most instructive and will commend itself to those who desire information on this important subject.

I have the honour to be, sir,
Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

CONTENTS.

	Page.
Part I.	7
Significance of the term 'Quality' in regard to wheat and flour	7
Purposes for which wheat is used	8
Breeding new varieties of wheat of high quality	8
Methods of estimating strength of flour	10
Preparation of wheat for milling	11
Description of experimental flour mill and method of milling	11
Descriptive terms for flour	12
Method of conducting baking tests	13
Baking strength of flour	17
Flavour and nutritive value of bread	19
Tables	20
Notes on some varieties of wheat	28
Commercial flours	31
Influence of age on wheat and flour	31
Variations in flour strength due to soil and climate	32
Appearance of wheat not a trustworthy indication of quality	33
Mixed flours	35
Variations in the methods of bread making	35
Tea biscuits	35
Part II.	37
Relationship of composition to bread making value	37
The nature of gluten	37
Components of flour influencing 'strength' according to T. B. Wood	38
(a) Sugars—Influence of, on size of loaf	38
(b) Soluble salts—Effect of, on quality of gluten and shape of loaf	38
The character of analytical data as compared with that of baking results	39
Flours—Series I.	39
Composition of—tabulated	40
Discussion of analytical data	41
Gliadin—Influence of strength of alcohol on percentage obtained	42
Sugar-content, not a measure of volume of loaf	43
Relationship of protein to gliadin and dry gluten	44
Relationship of analytical data to 'Baking Strength'	45
Flours—Series II.	45
Composition of—tabulated	46
Discussion of analytical data	48
Relationship of protein to gliadin and dry gluten	49
Relationship of analytical data to 'Baking Strength'	49
Summary	50
Acknowledgments	51

QUALITY IN WHEAT.

PART I.

By CHAS. E. SAUNDERS, B.A., Ph.D., Cerealist.

The fact that both wheats and flours differ considerably in their characteristics has long been known, although the ideas generally prevalent in regard to these differences have not been very definite and there has been comparatively little effort made to discover the relationship between the peculiarities of the wheat kernels and those of the flour produced from them. As a rule, too little attention has been paid by farmers to the question of quality in flour, the varieties of wheat giving the largest yield being usually grown, regardless of any other considerations. Of late years, however, more thought has been given to this question of quality, and the price of wheat is now regulated to a certain extent by the opinion which the buyer forms as to the probable quality as well as the quantity of the flour which can be obtained from the grain.

In the new wheat districts of central and western Canada the importance of raising wheat of high quality has usually been recognized. The great distance of some of these areas from the sea coast makes it essential to produce wheat of high quality so that the cost of transportation to the centres of commerce shall not be too great in proportion to the value of the grain. Some sections of the prairie country have too short a season to ripen regularly the later maturing varieties of wheat, and it is clearly imperative, in breeding new sorts of early-ripening habit for these districts, to keep the question of quality constantly in mind. In the older parts of Canada, where farming has been carried on for many years, the tendency to sacrifice quality to yield has been instrumental in reducing the average value of the wheat below the high standard which it might have retained had more attention been paid to this question.

It will be seen, therefore, that there are two chief problems included in the subject of this bulletin, the first being the breeding of new sorts of wheat of high quality (especially for some of the more northern sections of our country), and the second being the determination of the quality of the varieties now in cultivation so as to be able to give to farmers in all parts of Canada definite advice as to the best sorts for them to grow. The first of these problems, the breeding of new varieties of high quality, though of prime importance and occupying a very large part of the writer's attention, does not require lengthy treatment in this bulletin. Most of the space will therefore be taken up with the question of testing wheat for quality under the usual conditions when a fair quantity of pure seed is available.

The investigations reported in this bulletin are by no means complete, some of the problems having, as yet, only been touched upon. The results reached, however, are of some importance and it has been felt that it would be unwise to delay the publication of them for an indefinite period. It is expected that this work will be continued for a considerable time yet, as many important questions have still to be studied.

SIGNIFICANCE OF THE TERM 'QUALITY' IN REGARD TO WHEAT AND FLOUR.

In discussing the quality of wheat, one has to consider both the miller's and the baker's point of view. These two are often confused and the term 'milling quality' or 'milling value,' is sometimes employed in the same sense as 'baking quality.' The miller desires primarily a large yield of flour of good appearance; while the baker is not directly interested in the yield but requires the flour to be of such appearance and

strength as will suit his particular purposes. It might happen therefore that a sample of wheat of excellent milling quality might yield flour quite unsatisfactory to the consumer; and on the other hand a poor, somewhat shrivelled sample of wheat, might give a small yield of flour possessing admirable baking qualities.

In referring to flour, the terms 'quality' and 'strength' are often used as if they had the same significance, which is not strictly true. The term 'strength' conveys a fairly definite idea even though slightly different meanings may be attached to it at various times. 'Quality,' however, obviously signifies suitability for the purpose intended. A flour of high quality for pastry is a flour of low strength, whereas a flour of high quality for the production of very light bread or for mixing to improve the strength of weak flours, must be of high strength.

PURPOSES FOR WHICH WHEAT IS USED.

It may be well before going further to mention some of the different purposes for which wheat is used. Of these, bread-making is no doubt the chief, and for this purpose strong flour is most popular, both because it will usually give light bread, even in the hands of a careless worker, and because its water absorption is generally high, a distinct advantage to the baker who sells his bread by weight. For household purposes, where only one kind of flour is used, varieties of the very highest strength are centainly not to be preferred. Very good bread can be made from flour of moderate strength, and such flour is also fairly well adapted for the making of biscuits, cakes and pies, which are usually rather tough and indigestible when made from very strong flour. Flour of really low strength is however undoubtedly the best for pastry. For the making of cereal breakfast foods, many of which consist chiefly, or altogether, of rolled wheat, the manufacturers prefer varieties with plump, round kernels and a yellow skin. The presence of a considerable quantity of gluten is said to be also an advantage from the manufacturer's, as it certainly is from the consumer's, point of view. Wheat is also used for the production of macaroni, for which purpose very hard glutinous sorts are found most satisfactory. Occasionally wheat is grown for the purpose of feeding chickens, in which case, no doubt, highly glutinous varieties are to be preferred.

The consideration of these different uses makes it clear that it is not strictly accurate to refer to the strongest wheat or flour as the best. It is the best only for certain purposes. For other purposes weaker flours are best. Farmers who grow wheat, should, therefore, consider the use to which it is to be put and should select the variety to be cultivated just as they would select an animal for the particular purpose for which it is required.

BREEDING NEW VARIETIES OF WHEAT OF HIGH QUALITY.

From the very inception of the Dominion Experimental Farms a good deal of attention was given to the breeding of wheats of high quality and early maturing habit. This work was, for some years, under the personal supervision of the Director, whose many duties, however, made it impossible for him to devote as much time to it as seemed desirable. Other causes also operated to make progress in those days somewhat more difficult than it is at present. One of the great difficulties was due to the large amount of wheat required for a milling test and to produce flour for baking purposes. During the last few years, since the establishment of the Cereal Division, the installation of suitable apparatus for grinding small quantities of wheat and for conducting baking tests with the flour so obtained makes it possible to determine accurately the quality of any variety, even when only a very small amount of seed is available. Considerable knowledge has also been gained by plant breeders during the last twenty years and the problems can now be attacked with greater assurance of success than was possible two decades ago. From the outset of this work efforts were made principally to combine the high quality of Red Fife wheat with the early maturing habits of other

varieties, the quality of which was usually unknown. The system of selection following the cross-breeding was less rigid at first than that which is now employed. For the last few years the method of selection by single plants only has been used on this farm. The seed of every plant saved is always sown separately until after it has been found that the characteristics of each particular strain are quite fixed.

From the beginning it was found to be extremely desirable to have some method of estimating the quality of the grain produced by individual plants. It has been well known for a long time to practical wheat buyers that some rough idea of the baking strength of flour can be obtained by chewing for about four or five minutes a few of the kernels of the wheat from which the flour is to be made and then examining in the fingers the gluten thus obtained. After having carried out this simple test for a large number of times, the writer found that it was possible to acquire considerable facility for judging quality by this method and for the last two or three years he has used it very extensively, chewing, usually, about ten or a dozen kernels from the crop of each plant which is being considered as a possible mother plant. As a general rule, it may be said that the strongest flour will be obtained from those wheats which produce gluten having the greatest ability to recover its shape after being squeezed between the fingers. The variations in the quality of the gluten observed in different plants of the same pedigree are often very great, and it is not claiming too much to say that this simple and apparently inefficient method of testing enables one to select with a fair degree of certainty a few of the best plants each season and thus enormously reduces the labour which would otherwise be involved in multiplying a large number of strains, most of which would ultimately be rejected. That this crude method of testing is infallible one cannot maintain. The writer has, however, shown by actual baking trials that it possesses sufficient accuracy to be worthy of the very serious attention of all wheat breeders, though an investigator may have to perform the test several hundred times before acquiring any proficiency in it. It is not really a very difficult matter to judge in this way, as a rule, with fair accuracy, both the gluten strength and the colour of the flour which would be produced from the wheat in question, and if time were taken to weigh the wheat used and the globule of gluten produced it would certainly be possible to form a rough estimate of the proportion of gluten which the wheat would yield. The writer does not know whether this method of judging the quality of individual plants has been used by other investigators or not, but he would strongly recommend it as imperatively necessary for anyone attempting to breed wheat for high quality. It requires some patience and a fairly good set of teeth, but these two attributes may be considered essential to all breeders of wheat. A study of the later sections of this bulletin will make it clear to anyone that the usual observations on the colour and hardness of the kernels are almost useless for estimating flour strength in breeding new wheats. The chewing test is certainly of great value, though it should always be confirmed by actual baking trials as soon as sufficient wheat is obtainable for that purpose.

By the use of this method, combined with observations on earliness, productiveness, &c., the writer has reselected all the important cross-bred varieties of wheat produced from the crosses made by Dr. Wm. Saunders, by Mr. W. T. Macoun and by Dr. A. P. Saunders, as well as those made by himself some years ago. These new, selected strains have been propagated in every case from selected single plants and show a degree of uniformity which is quite remarkable. Among them are some very promising sorts.

The progeny of the new cross-bred wheats produced by the writer during the last few years have all been subjected to the chewing test and selections made accordingly.

A special instance of the usefulness of this test may be of interest. Some years ago an experiment was tried in order to obtain if possible a natural cross between two varieties of wheat. Red Fife (beardless) and Rio Grande (bearded) were sown mixed in a small plot. When the grain was ripe a few heads of Red Fife, which were borne on rather short straw, were selected, and from these the next season about 200 kernels

were sown. Among the plants produced from these seeds, one was found on which the awns were somewhat better developed than is usual in true Red Fife. When some of the seeds of this plant were chewed it was found that the gluten quality was altogether distinct from, and decidedly inferior to that of Red Fife. In this way it was proved that the plant was a cross, the pollen from the Rio Grande having fallen on the head of Red Fife during the blossoming period in the year previous. As this proof, however, would not perhaps be accepted by other observers without confirmation, the seeds from this cross-bred plant were sown the following year. They produced mixed types, bearded, partly bearded and beardless. The seeds as well as the heads showed the influence of the Rio Grande, being, in many cases, larger than those of Red Fife. These observations of course completed the proof of the cross-bred nature of the parent plant, and demonstrated the value of the chewing test as a means of distinguishing similar varieties of wheat.

METHODS OF ESTIMATING STRENGTH OF FLOUR.

The commonest methods of estimating the strength of flour should perhaps be mentioned here before proceeding further. Buyers of wheat often attempt to judge the quality of the flour by the appearance of the grain: hardness, colour, plumpness and condition of the skin being the points most commonly considered. These characteristics are however very uncertain guides as to quality and are sometimes altogether misleading. When the wheat has been ground an attempt is sometimes made to estimate the strength of the flour by its colour or by its granularity or softness. These methods of judging are also of comparatively little value. The mechanical gluten test by washing the starch out of a small quantity of dough is certainly of some value in determining the quality of the gluten. Similar to this is the chewing test; particulars of which have just been given. Efforts to estimate the expansive force of gluten under the influence of heat have been made by the use of the aleurometer, an instrument which has not given satisfactory results. The baker's sponge test is perhaps a better method. It depends on observing the height to which a certain quantity of dough will rise in a cylindrical vessel under the influence of yeast fermentation. No system of chemical analysis yet devised seems to give conclusive and satisfactory estimates of the strength of flour for bread-making purposes. After considering all the methods above mentioned, it becomes quite clear that nothing can yet take the place of the actual baking trials. For this reason much attention has been given to these tests in preparing this bulletin, and they have been carefully repeated several times in each case, so that the results obtained might be quite trustworthy.

EARLY MILLING AND BAKING TESTS.

Before the system was devised, according to which most of the tests reported in this bulletin were carried out, a considerable amount of preliminary research was necessary. During this period some valuable results were obtained, but most of the work has since been repeated in a better form and the earlier determinations need not, therefore, be mentioned here. One rather important variety of wheat, however, has not been studied during the last couple of years as the first tests sufficiently demonstrated its inferiority. The variety referred to is commonly known as Club wheat, and has a small thickened head with red chaff. The grain itself is sometimes very fine looking, and has an attractive red colour when well ripened. In some cases it can scarcely be said to be inferior in appearance to Red Fife. The flour produced from it is, however, of a dark, unattractive yellow colour and is decidedly wanting in strength, producing bread which is by no means acceptable. It seems necessary to call attention again to the poor quality of this wheat as it has been grown for some years in certain sections of Canada. Its cultivation is to be deprecated in any part of the country from which wheat is exported for the production of strong flour.

In Bulletin No. 50 of the Experimental Farm series on the Milling and Chemical Value of the Grades of Wheat in the Manitoba Inspection Division (Crop of 1904) careful details were given as to the milling qualities of the various grades. Baking tests of the 'straight' flour produced from each grade were also made but most of the results of these tests were stated only in general terms. The conclusion was drawn that there was no difficulty in making excellent bread from almost all the grades, but no attempt was made to determine exactly the strength of the flour in each case, the object of the investigation being primarily to determine the value of the wheat for milling purposes.

PREPARATION OF WHEAT FOR MILLING.

As it is well known that wheat improves with age, for some little time after harvesting, the milling tests in connection with the present investigation, have not usually been begun until the month of December. For some weeks before grinding, the samples of grain are stored together under uniform, dry conditions. The greatest care is taken to study only fixed, pure varieties of wheat. Commercial sorts, being seldom quite pure, are usually avoided. The quantity of wheat ground is usually about 600 grammes. Previous to grinding it is carefully sifted and cleaned by hand until free from very small kernels and all foreign matter. About 4 per cent, by weight, of water, is then added, the grain being thoroughly mixed and allowed to stand in a small, covered vessel for about half an hour before the milling is commenced. The practice of millers in regard to the moistening of wheat previous to grinding varies very much but the method just mentioned has been found to be quite satisfactory. If the wheat is allowed to stand for a longer period than half an hour the moisture seems to penetrate too far. The object of the moistening is of course simply to reduce the brittleness of the bran so that it may not be broken up into very small particles by the break rolls.

DESCRIPTION OF EXPERIMENTAL FLOUR MILL AND METHOD OF MILLING.

The apparatus used for the milling of the samples of wheat to be examined was made by the Allis-Chalmers Company of Milwaukee, Wisconsin, and consists of two small mills, one having a pair of corrugated rollers and the other a smooth pair. The machine is also provided with a sifting apparatus and a set of twelve sieves running from No. 16 wire gauze, with meshes of about one-sixteenth of an inch, up to No. 14 silk, which has approximately 140 meshes to the running inch. Large commercial mills are of course always equipped with several kinds of rollers as well as a middlings purifier, where the purification of the partly reduced wheat is assisted by a blast of air. For experimental purposes, however, working with necessarily very small quantities of wheat, there is an obvious objection to multiplying the pieces of apparatus employed and the simple form of mill just described is quite satisfactory.

As a rule four 'breaks' are given, the material which has passed through being sifted after each break to remove the flour and fine middlings produced. Afterwards, several reductions are made with the tailings from the different sieves until all the flour of comparatively high grade has been obtained. One or two further reductions for low grade flour are then carried out last of all. No attempt is made, as a rule, with this apparatus to produce patent flour, the flour used for analysis being in all cases what is called 'straight grade' and includes all the flour suitable for the making of bread. It is of course quite impossible, in a small experimental mill, to produce flour of the very finest colour. This will be easily understood when it is remembered that it is necessary to run all the materials through to the very end in each operation and then to stop the machinery and to thoroughly brush out the inside of each mill and the sifting apparatus. The impossibility of obtaining the best colour does not, however, interfere with the accuracy of the results, because all the samples are treated alike and are judged by their relative instead of their absolute colour.

The percentage of flour produced from any sample of wheat can be estimated by this apparatus with considerable accuracy. In Bulletin No. 50, details were given as to the milling value of the different grades of wheat in the Manitoba Inspection Division. But in order to obtain trustworthy results of this character it is necessary to use very great care and to perform each milling test at least twice. This requires a large amount of time and consumes more wheat than is sometimes available. In the present instance, therefore, the percentage of flour obtained from the different varieties was not determined for publication. The percentage of break flour, however, is given in one of the tables, because, as a rule, this is a trustworthy figure even from one determination, and it will serve a useful purpose in giving some idea of the hardness of each variety of wheat. The percentage of break flour is calculated by taking the total weight of the flour, shorts and bran produced as 100. In using a mill of this character, the total products obtained usually show a loss of about 2 per cent as compared with the weight of wheat taken. All the flour is sifted through a No. 10 silk sieve. This of course does not give an extremely fine product but has proved quite satisfactory for the comparative tests here recorded. After the flour has all been produced it is sifted again through No. 9 silk in order to mix it thoroughly. The separation of the bran from the shorts and the quantitative estimation of these were considered unnecessary in the present investigation.

DESCRIPTIVE TERMS FOR FLOUR.

There are two well recognized classes of flour, though of course they do not include all samples, as specimens with intermediate characteristics are occasionally found. For the description of these two classes different terms are used. One type of flour may be conveniently described as soft, smooth, velvety, or light. Such flour is usually produced by the milling of soft, starchy wheat. The peculiar smooth and velvety feeling of this flour is quite characteristic and forms a striking contrast to that of the other class. The second class of flour is described as hard, granular, heavy or, sometimes, lively. Even though it has been sifted through as fine a sieve as that used in producing the softer kinds of flour, it nevertheless feels somewhat gritty between the fingers and may be poured from one vessel to another more easily than soft flour. Altogether it distantly suggests extremely fine sand. The terms used in this bulletin for these two types of flour will be *soft* and *granular*, as these two words perhaps most conveniently express the striking characteristics of each class. It is generally understood that soft flour is weak and is therefore suitable for the production of pastry, biscuits, &c., and that granular flour is strong and adapted to the making of extremely light bread. While this is true in many cases, an examination of the following tables will show that numerous exceptions occur. Several distinctly granular flours are here mentioned which were found very unsatisfactory for bread-making while good bread was produced in some instances from distinctly soft flour.

The descriptive terms used for colour refer in every case to the flour in its natural, dry condition. The observations were made when the flour had been kept for about two weeks after milling. Not very much importance is attached to the colour because, as is well known, it varies a good deal with the age of the flour and also because the introduction of bleaching processes makes colour a matter of somewhat less significance than it was some years ago. As already explained, the colour of the flours produced by a small experimental mill cannot be very good, but it gives a fair idea of the relative values of the different samples in this respect. The colour after moistening and drying the flours was also studied, but the results obtained in this way did not seem to be of very much importance in view of the fact that the colour of each sample was being carefully studied in the bread. This is undoubtedly the point of most significance, and, therefore, no attempt was made to record with great precision the colour of the different samples of flour.

METHOD OF CONDUCTING BAKING TESTS.

The milling tests are usually made in the month of December and the samples of flour obtained are placed in paper bags and all kept together in an ordinary (heated) room for about two weeks or more before being baked. The baking tests are performed in midwinter, usually in the months of January and February, in order to secure uniform conditions of dryness in the flour, except in so far as it may be natural for flours to differ in moisture content. This very important point has not always received sufficient attention from scientific investigators. Comparisons made between flours which have not been kept and studied under uniform conditions in regard to moisture are usually of very little value. The atmosphere in a laboratory in this climate is extremely dry and comparatively uniform for the winter months, during which time, of course, constant artificial heat is maintained. It is, therefore, possible to make satisfactory comparisons between tests carried out in different years without the necessity of considering the moisture content as a variable factor, provided the tests are all made in midwinter. The difference in moisture content of flour between our midwinter and midsummer conditions has been shown by Mr. Frank T. Shutt to be usually about 4 per cent or even more, an amount so great as to destroy the value of any analyses or tests which might be made without this being taken into consideration.

The fermenting cupboard used in the bread-making is of wood with a glass front and is divided by a central shelf in which are numerous holes to allow free circulation of air. The cupboard is provided with a thermometer and heated by electric lights placed below the shelf and so arranged as to give an evenly distributed heat. When in use it is kept at a temperature of 33 to 35 degrees centigrade (92 to 95 degrees Fahrenheit). As it is essential in working with small quantities of dough that the atmosphere of the fermenting cupboard should be very moist in order to prevent the formation of a crust on the surface of the dough, a low zinc pan is placed under each electric light, and in this a quantity of water is kept which becomes quite warm and gives off a large amount of vapour. In order to observe carefully the height of the dough during fermentation, wires are passed through the top of the cupboard in such a way as to be controlled from outside and so arranged that they can be moved upward from time to time and kept a short distance above the top of the rising dough.

For a test loaf 50 grammes of flour are used. This amount might perhaps be advantageously doubled if the quantity of flour on hand permitted, but in using large amounts of flour there is no apparent gain to counterbalance the obvious objections. It is of the utmost importance to repeat the baking tests several times with each sample of flour and on that account the use of a comparatively small quantity for each loaf is essential when the total quantity on hand is small. In this work as a rule four loaves were made from each sample of flour, each loaf being baked in a separate batch. The results given in the tables represent the averages of the observations made on the four loaves. In the case of strong flours, the different bakings usually agreed very closely, but with weak flours it was found much more difficult to obtain uniform results, owing to the tendency of the dough to fall when allowed to ferment a little too long, or when disturbed by the transferring of the tin to the oven.

To 50 grammes of flour seven-tenths of a gramme of salt are added. The flour is then placed in the fermenting cupboard to become slightly warm. To 20 cubic centimetres of tepid water, one and two-tenths grms. of moist, compressed yeast are added and six-tenths of a gramme of cane sugar. This mixture is placed in the fermenting cupboard for about 20 to 30 minutes, until a rapid evolution of gas is observed. Exactly 20 cubic centimetres of this liquid are then added to the flour and the kneading is commenced. This amount of liquid is reckoned as 20 cubic centimetres of water, which though not strictly accurate, introduces no appreciable error, all the flours being treated in the same way. The exact quantity of water in 20 cubic centimetres of the yeast mixture at this stage is of course unknown. As much additional tepid water as is required to bring the dough to a proper consistency is added from a burette. The

first kneading is completed in about five minutes. The dough is then placed in a glass vessel and returned to the cupboard. When the dough has risen to about two and a half times its original volume, it is taken out and kneaded in the hands for three minutes. It is then placed in a small round tin having sides 27 millimetres high (about 1 inch) and a diameter of 80 millimetres (about 3½ inches). The tin is returned to the cupboard and the dough allowed to rise as high as possible without spreading too much over the sides of the tin. In most instances the dough rises to about twice the height of the sides of the tin. When it is judged that the dough will not gain further volume by prolonging the fermentation, it is placed in the oven and baked for about twelve minutes at 225-230 degrees centigrade (437-446 degrees Fahrenheit). The oven is heated with gas and provided with a thermometer and a rotating shelf to insure uniformity in the baking of the loaves. A perfectly uniform time of baking cannot fairly be used, as the lighter loaves bake more quickly than those that are compact. The heavier loaves are therefore left in somewhat longer.

It is quite a difficult matter to judge when the dough should be transferred from the fermenting cupboard to the oven and the practice of different investigators varies much in this regard. Some give a uniform time for fermentation while others require the dough to rise to a certain uniform height before being baked; but these methods are both open to rather serious objections and it seems to the writer that the plan here adopted gives to each kind of flour the best possible chance to show fully the strength it possesses. Of course, if a weak dough be left too long in the fermenting cupboard it may fall, especially when being transferred to the oven; and in some cases the loaf so produced may be much less in volume than that obtained in other bakings. This falling, however, would certainly occur occasionally in ordinary baking, and the average volume obtained by the writer's method is no doubt as great as that which would be obtained by ordinary bakers, except when they use tins with high sides. In the case of strong doughs there is very little difficulty in manipulation, since even though they may be spreading somewhat over the sides of the tin when put into the oven or may be showing some slight tendency to fall they will usually recover their shape and sometimes gain in height under the influence of the high temperature. The difference in the conduct of various kinds of dough when put into the oven is one of the most striking features observed in the baking tests and appears to be entirely due to the differences in the quality of the gluten at the close of the fermenting period.

When the bread is baked the height of the loaf is compared with the height of the dough before it was put into the oven, and a note is made as to whether there was any gain or loss in height during the baking. The loaf is allowed to cool for an hour and is then examined. The nature of the observations made on each loaf will be seen in the tables headed 'Baking Tests.' Some explanation of the significance of each of the columns of figures included under this general heading will now be given.

WATER ADDED TO 100 GRAMMES OF FLOUR.

Some writers use the term 'strength' to designate the ability of flour to take up water in making dough of a standard viscosity, and an instrument called a 'viscometer' has been devised for the purpose of making careful comparisons between different samples of dough. Flours differ, however, so much that, as a matter of fact, they cannot all be worked up into the same kind of dough. Some doughs are sticky while still very stiff, and others do not become sticky at all unless made very slack. The information obtained by the use of the viscometer is of comparatively little value, because in some instances a slack dough will give a loaf of good shape, even after long fermentation, and, in other cases, a very stiff dough will ultimately spread over the sides of the baking tin if these are not very high and produce a loaf of a very poor shape. A baker needs to know how much water can be added to the flour without spoiling the shape of the loaf. Other things being equal, he will prefer the dough which takes up the largest quantity of water, as such dough is usually the most slack and the easiest to work.

Though the test loaves are made from 50 grammes of flour it is preferable to express the results in terms of 100 grammes. This simple form is so obviously the best that it seems strange that some investigators prefer to express the water absorption in such terms as 'quarts per sack.' The figures given in this column can be converted into quarts (of 40 ounces) of water per sack (of 280 lbs.) of flour by multiplying by 1·12.

WATER RETAINED BY 100 GRAMMES OF FLOUR.

The proportion of water retained by the bread when cool is of very great importance to the baker, the advantage to him of disposing of water at several cents per pound being quite obvious. It is a mistake, however, to regard flour as particularly valuable for ordinary household purposes when it has unusual power of retaining water. There is often more economy in purchasing flour which is rather weak in this respect and which, being less popular, can be bought at a lower price.

Although the figures given in this column would seem to be of great importance from a commercial point of view, it must be explained that they are necessarily quite inaccurate. Very light loaves of bread dry out more rapidly in the oven than loaves which are of medium or rather heavy character. It appears quite impossible to overcome this experimental difficulty, for, though it is evident that the lighter loaves should, for purposes of comparison, be left in the oven a shorter time, one cannot tell just what allowance to make in each case for the difference in volume. The percentage of water retained is not, therefore, a figure of much value except when comparing loaves of approximately equal value. It should be explained that the figures in this column indicate the amount of water retained by the bread in addition to that which was naturally present in the flour. The figure 40, for instance, signifies that 100 parts of flour by weight produced 140 parts of bread. These figures may be converted into 'loaves per sack' (4-lb. loaves per sack of 280 lbs.) by adding 100 to them and then taking seven-tenths of the total thus obtained; or they may be converted into 'loaves per barrel' (4-lb. loaves per barrel of 196 lbs.) by adding 100 and taking 49/100 of the total thus obtained.

VOLUME OF LOAF.

In this column is given the average volume of bread in cubic centimetres produced from 100 grammes of flour, this appearing to be the best method for the expression of volume. Opinions will no doubt differ very much as to the degree of lightness which is desirable in bread and it is to be noted that some kinds of flour produce bread of fair quality when the volume is quite small; while other flours, which make bread of a tougher character, yield a loaf which is undesirable unless it is of rather large volume. There cannot, therefore, very well be any standard volume for a loaf of good bread. Roughly speaking, however, it may be said that bread which has a volume of less than 400 cubic centimetres (for each 100 grammes of flour) is distinctly heavy. Bread having a volume of 400 to 429 cubic centimetres may be classed as rather too compact, though one occasionally finds desirable loaves within these limits. From 430 to 449 cubic centimetres the bread is of medium lightness, sometimes very good in quality. From 450 to 509 cubic centimetres we have bread which is rather light; from 510 to 550 cubic centimetres it is very light; while any bread reaching a volume of more than 550 cubic centimetres may be regarded as unnecessarily light. When baking tins with high sides are used, bread can sometimes be produced having a considerably larger volume than that indicated by this latter figure.

The volume of each loaf is observed by determining the amount of flax seed displaced by it, using a vessel of known capacity. This is much more accurate than any system of measuring. The volume attained depends primarily on two factors which are somewhat distinct from each other: the first being the ability of the dough to rise in the fermenting cupboard and the second being its ability to hold or to increase its

volume when transferred to the oven. Some doughs stop rising when only a medium volume has been reached, but show very good ability to maintain that volume; while others may rise to a fair height but exhibit a decided tendency to fall in the oven. Very strong doughs rise well during fermentation and hold or increase their volume in the oven.

In this connection it seems necessary to refer to the interesting theory recently advanced by Mr. T. B. Wood, M.A., (Journal of Agricultural Science, April, 1907) that the volume of a loaf depends upon the amount of gas evolved during the later stages of the fermentation, the quantity of gas being itself dependent on the amount of yeast food available. Among the proofs advanced in favour of this idea may be mentioned the experiments in which a quantity of sugar was added to the dough at the final kneading. It was found that a greater volume of loaf was reached by those doughs to which sugar had been added. It may however be pointed out that the apparent value of this test is somewhat lessened by the fact that the doughs were allowed to rise for only 30 minutes after the addition of the sugar and that nearly all the loaves produced were heavy (below 400 cubic centimetres volume from 100 grammes of flour). This experiment therefore gives very little clue as to what might have been the relative rank of the doughs if each had been allowed to attain its best volume for the production of really light bread. Some cases which have come under the writer's observation lead him to believe that Wood's theory is of value in explaining certain unusual phenomena, but he cannot accept it as by any means covering the whole question of volume. One cannot lose sight of the fact that while some doughs rise in the oven, others fall. The difference in conduct in this respect is often extremely striking and as it is all brought out within a period of about three minutes (under the baking conditions of these experiments) it seems clearly to be due to the inherent qualities of the gluten and not to any differences in the volume of gas produced by the yeast in so short a period of time.

HEIGHT OF LOAF DIVIDED BY DIAMETER.

In carrying out these tests it has been recognised that flour from Canadian wheat is baked under two radically different conditions, sometimes in tins with high sides and at other times without any support, in the form known in England as the cottage loaf. Since it was known that exactly the same results as to volume would not be obtained by these two different methods of baking and since it was impracticable to carry out all the tests in both forms an intermediate type of loaf was adopted, the bread being baken in a tin having sides approximately half the height of an average loaf. In this way some indication was given as to the ability of the dough to rise when supported while some information was also obtained as to its tendency to spread when unsupported. Under such conditions the shape of the loaf depends partly on the strength of the flour. The weak flours produce dough which has a tendency to run over the sides of the tin, while the dough made from strong flours holds itself well together and rises without any appreciable spreading. A loaf made from flour of what might be called ideal strength would have a height approximately equal to its diameter and would be in the form of a sphere. A loaf made from extremely weak flour would of course rise scarcely at all above the edges of the tin so that its height would be about the same as that of the tin while its diameter would be equal to or greater than that of the tin. In practice it is found that the height of the loaf divided by the diameter, using the kind of tin here described, usually gives a figure ranging between .60 and .73, the loaves varying from about 42 to 60 millimetres in height and from about 75 to 88 millimetres in diamter.

FORM OF CRUST.

The figures in this column are determined by inspection, the ideal crust being taken to be one which is perfectly uniform and of a regular, dome shape. Cracks in

the crust or an irregular wavy form are considered objectionable. A mark of 100 indicates a strictly first-class crust but is not taken as indicating perfection. Occasionally a mark as high as 105 may be given. A mark of 70 indicates an extremely poor crust; while the marks between 70 and 100 indicate various degrees of excellence between these two extremes.

TEXTURE.

The mark for texture is also necessarily empirical, owing to the obvious difficulty of accurately measuring and recording the average size of the minute holes in the bread. The ideal texture is regarded as one which is extremely fine and perfectly even. Bread with such texture would be comparatively easy to cut and to spread with butter, even when made extremely light. The size of the cells in bread is not always a good indication of the lightness of it, because the large cells frequently have very heavy walls, while, when extremely strong flours are used, though the cells may be quite small, the walls are so thin that very little dough is required to produce a loaf of large volume. Texture is a matter of considerable importance and one in regard to which very great differences are observed.

INSIDE COLOUR.

The inside colour of the bread is recorded on an empirical scale somewhat similar to that used for form of crust and for texture. Observations under this heading are necessarily difficult when great accuracy is required, but the figures given in this column can be relied upon to a large extent, as they represent in each case the average of several independent observations. As a rule 8 or 10 kinds of flour were baked each day, so that the observations on colour as well as those on texture and on form of crust (all of which depend on comparisons and not on measurements of any kind) were made fairly trustworthy.

TIME OF FERMENTATION.

The figures given in this column are of comparatively little value, since various causes operate to alter the length of the fermentation period in different cases. In some instances long fermentation is necessary in order that a very strong dough may have time to rise to its largest possible volume, while in other cases a long period may be necessary, owing to the comparatively slow rising of a dough which cannot, in the end, reach any great volume. The greater the quantity of water added, the shorter is the time of fermentation required, that is, when the two tests are made with the same flour. A stiff dough usually rises very slowly, and, in some cases, a larger quantity of water cannot be added on account of the tendency of the dough to spread over the edges of the tin when made rather slack. With other flours a slack dough can safely be made, thus causing a more rapid action of the yeast.

BAKING STRENGTH.

The desirability of expressing in a numerical way the baking strength of every flour is clearly evident after the inspection of the following tables containing several columns of observations on the different characteristics of the various flours. It is a common custom to adopt some one flour as a standard and refer all others to that, often ignoring the fact that the strength of the standard flour itself may change as it becomes older. Sometimes one sample is taken as a standard for spring wheats and another for winter wheats without making any attempt to bring both types to the same standard of measurement and without recognizing the fact that within each of these groups there are very great variations. The experiments here recorded show very clearly these variations and also prove that flour from winter wheat is in some in-

stances stronger than that produced from spring wheat, a fact which serves to emphasize the futility of the old classification. It appears to the writer imperative to establish a scale of strength, based on such figures as are given in the tables headed 'Baking Tests,' so that the baking strength of any sample of flour can be definitely recorded for future reference, that the values of different flours may be readily compared and that the use of standard flours may be discontinued. As has already been pointed out, the term 'strength' is sometimes used in relation to water absorption only. The more general usage, however, includes perhaps all of the factors of which use is made in this bulletin. 'Strength' in flour may be roughly defined as the ability to take up and to retain water and to produce a large high loaf (even when unsupported by the tin) with a regular, even crust and fine texture. Such a definition may be somewhat more broad than is generally recognized, but it expresses with fair accuracy the characters which influence an ordinary baker in passing judgment on the strength of any flour. In estimating baking strength the first six columns of figures, under the heading 'Baking Tests' are used: that is to say, water added, water retained, volume of loaf, shape of loaf, form of crust and texture. Inasmuch as the figures in these columns are sometimes unrelated, simple addition would give to some of them so subordinate a place that they would scarcely influence the resultant figure at all. In order, therefore, to bring them to the relative prominence which they should have, the following method is used: The figure in the first column (water added) is multiplied by two, that in the second (water retained) by five. The figure for volume is taken as it stands. The figure for the shape of the loaf is multiplied by 500, that for form of crust by two, and that for texture by three. The sum of the figures thus obtained is usually between 1,500 and 1,700. Any scale of strength dealing with such large figures would be very clumsy, and, therefore, for the purpose of bringing the figures to a scale of moderate proportions and for the sake of emphasizing somewhat the differences between the different kinds of bread, the writer has adopted the arbitrary practice of subtracting 700 from the total obtained and dividing the remainder by 10. This gives a scale of points for flour strength which runs usually from about 70 to 100, but is not limited in either direction. One hundred represents not perfection but simply a flour very high in strength. Seventy represents a flour very low in strength. Exceptional flours may obtain a mark above 100 or below 70, but these figures are the usual limits.

As has already been partly explained, excessive strength in flour is not really very desirable except for mixing purposes. It may safely be said that the very strongest flours, owing to the toughness of the dough made from them, do not always produce the best quality of bread; while for the making of pastry, cake, soda crackers, &c., they are not suitable. Much of the so-called pastry flour sold in Canada is identical with the flour sold for bread-making and contains gluten of very strong character. This partly accounts for the fact that Canadian pastry has not a high reputation for quality. Some millers even go so far as to advertise a particular brand of strong flour as of the highest quality both for bread and for pastry—about as accurate a statement as if one were to claim for a horse that he was unexcelled both for racing and for draft purposes. The actual facts need to be emphasized: that the strongest wheats such as hard Canadian Red Fife, are of great value for mixing with other sorts which are too low in strength but that the best and most wholesome bread is made from wheats, or mixtures, somewhat below the highest strength, while pastry and cakes require rather weak, starchy flours, such for instance as are made in Ontario from Dawson's Golden Chaff wheat and other winter varieties not specially strong in character.

Flour of great strength is usually somewhat scarce in the world's markets and therefore commands as a rule a very high price. Instances occur, however, when distinctly weak kinds of wheat or flour are sold at higher prices than those of great strength. It is purely a question of supply and demand; and it is important to remember, therefore, that although the strongest wheat or flour usually brings the highest

price, this fact proves its relative scarcity and its value for mixing purposes, but does not establish its worth for general household use.

The scale of strength here used needs a few further words of explanation. In some cases flours are given about the same figure for strength when they are really different in character. But this seems unavoidable. For instance, a weak flour which contains a large proportion of starch and not very much gluten is quite distinct from a weak flour which contains a considerable amount of gluten of very feeble character; though the two may earn the same mark for strength. The latter type of flour is often less desirable than the former. A starchy flour yields products which have a decided tendency to crumble and are often quite delicious and wholesome, even though somewhat compact; but a flour which contains a large amount of very poor gluten gives rather tough products, and cannot be made into bread of sufficient lightness to overcome this defect. A specific illustration will make this clearer.

It will be seen in the tables that Goose wheat (No. 123) gained 81 marks for strength while Dawson's Golden Chaff (No. 102) gained only 76. The Goose wheat flour yielded 15·86 per cent of dry gluten and the Dawson's Golden Chaff 9·55 per cent. The bread made from these two kinds of flour was almost identical in volume but that from the Dawson's Golden Chaff was of much better quality than the other. It may be stated as a general rule that when two flours are of equal strength better bread can be made from the flour containing the smaller amount of gluten. There are exceptions to the rule, however.

BREAD VALUE.

This term is to be understood in a commercial sense only. The ideal flour from a commercial point of view must possess great strength and a very pale colour; hence a flour of only medium or rather good strength and with a somewhat deep yellow colour would have commercially quite a low value for breadmaking, though it might actually produce better bread than some of the strongest and palest flours. The recent adoption of bleaching methods by many of the millers makes it very difficult to judge what importance should be attached to colour in flour, since flour of a pronounced yellow tint can now be much modified by the bleaching. The figures given for bread value in this bulletin are obtained by dividing by four the difference between the figure for baking strength and that given for inside colour. The product is then added to, or subtracted from, the figure for baking strength according to whether the figure for inside colour was greater or less than that for strength. Whether in this way too much or not enough value is given to the colour of the bread may be decided by each individual for himself.

FLAVOUR AND NUTRITIVE VALUE OF BREAD.

While it might be supposed that the flavour and the nutritive value of bread would be the two points of chief importance in determining its selling price, it must be admitted that this is by no means the case. Bread, like many other commercial articles is judged chiefly by appearance. Its nutritive value has apparently no influence whatever on the price and its flavour too is usually of little importance, provided it be not extremely sour. The natural supposition that bread is eaten either for pleasure or for the profit of one's body seems incorrect. At all events, flavour is so elusive a factor, so difficult to observe accurately and so dependent on the physical condition of the observer, that no attempt has been made to determine it, as a rule, in preparing this bulletin. Reference to the second part of the bulletin will show some interesting variations in the food value of the different flours. Undoubtedly, other things being equal, those which contain the largest proportion of albuminoids are the most valuable for bread-making, since albuminoids are a more expensive form of food than starch. The flours particularly rich in albuminoids produce loaves with a darker crust colour than

those which contain a larger proportion of starch. As has been pointed out, however, when the gluten is of poor quality and very light bread cannot therefore be produced a somewhat too firm and rather undesirable kind of bread is apt to be made from flours exceptionally rich in gluten. Bread that is of only moderate lightness should be somewhat friable, so that when being eaten it may easily be divided into small particles suitable for digestion. In spite therefore of their superior theoretical food value, those weak flours which are high in gluten are probably of less value for ordinary uses (unless employed in mixtures) than some of the more starchy flours.

Although it cannot, perhaps, be laid down as a definite rule, it certainly appears to be true in many cases, that the flours containing the largest proportion of albuminoids also possess the highest flavour.

VARIETIES ARRANGED IN SERIES ACCORDING TO BAKING STRENGTH, VOLUME OF LOAF AND SHAPE OF LOAF.

An inspection of the two tables which have this heading shows that there is, as a rule, a fair degree of agreement between the figures for baking strength and those for volume and for shape of loaf. It may be worth while, therefore, to attempt a rough classification of the samples of flour according to their strength and volume, so that anyone who may not wish to use the method of determining strength here described may be able to see the relationship between his own results and those here published by reference to the figures for volume only. The following groups, necessarily very roughly defined, may be given:—

Very Weak.—Baking strength under 70 or volume under 400. If starchy, such flours may be very useful for crackers or other special purposes. If glutinous or if they are to be used for bread-making they should be mixed with a considerable proportion of stronger flour.

Weak.—Baking strength 70 to 79 or volume 400 to 429. Often of the highest quality for cakes, pastry, crackers, &c. Also suitable for mixing with very strong flours for bread-making purposes.

Medium.—Baking strength 80 to 86 or volume 430 to 449. Usually good for most purposes, except for the production of very light bread.

Strong.—Baking strength 87 to 93 or volume 450 to 509. General purpose flours, suitable for households where only one kind of flour is used. The strongest flours in this group are somewat useful for mixing with weaker kinds.

Very Strong.—Baking strength 94 to 100 or volume 510 to 550. Suitable for the production of very light bread and for mixing with weak flours.

Of Remarkable Strength.—Baking strength over 100 or volume over 550. Chiefly useful for mixing purposes. If employed unmixed for bread-making the bread should be made extremely light to avoid toughness.

TABLES.

The tabulated results of the observations on the various samples of wheat and flour here follow. It has been thought most convenient to bring the tables together in two groups.

FIRST GROUP OF TABLES.

The first group of four tables gives the figures obtained during the winter of 1905-1906.

Milling tests, December, 1905-January, 1906.

Milling Number.	Variety.	Where and when Grown.	Weight per measured bushel.†	Percentage of break flour.*	Remarks.
			Lbs.		
95	Advance (Yellow).	Ottawa.....1905	.....	10	Flour, granular, yellowish.
87	Assiniboia.....	Neepawa, Man., "	64¼	9	Kernels rather hard, plump, dark red, bright. Flour granular, yellowish.
81	Aurora..	Ottawa..... "	61½	6½	Kernels hard, not very bright. Flour granular, yellowish.
99	Colorado, No. 50...	Colorado.....	63	... .	Kernels rather soft, plump, yellow, dull. Flour soft, pale.
90	Gatineau.....	Ottawa.....1905	....	10½	Flour somewhat granular, cream colour.
88	Huron (Selected)..	" "	62	10	Kernels hard, red, moderately plump but not bright. Flour granular, deep cream colour.
98	Laurel.....	" "	59	13	Flour soft, pale.
83	Red Fife H.....	" "	61½	10½	Kernels hard, fairly plump but not bright. Flour granular, cream colour.
85	Red Fife, Soft....	Neepawa..... "	62½	15	Kernels very soft, pale red, bright, plump. Flour somewhat granular.
86	Red Fife, Hard...	" "	63½	10	Kernels very hard, dark red, bright, plump. Flour granular, cream colour.
93	Red Preston.....	Ottawa..... "	.....	.....	Flour granular, deep cream colour.
84	Yellow Cross.....	" "	64¾	9½	Kernels plump and rather hard. Flour soft, pale.
91	9 J 3.....	" "	59½	13	Kernels large, soft, dull in colour. Flour rather soft, pale.
92	Turkey Red.....	Kansas.....	60¾	11	Kernels small, hard, dull in colour. Flour granular, dark cream colour.

† One pound (avoirdupois)=453.59 grammes. One bushel (imperial)=36.328 litres.
* The total weight of mill products obtained is taken as 100.

In addition to the samples of wheat mentioned in the table, baking tests were also made with flour produced in 1904 (Milling No. 3) from Red Fife wheat grown at Ottawa in 1902. This wheat was plump but rather soft and weighed 61½ pounds to the measured bushel. The flour produced from it was of a granular character and of a fine creamy-white colour.

Baking tests, January-March, 1906.

Milling Number.	Variety.	Water added to 100 grammes of flour.	Water retained by 100 grammes of flour.	Volume of loaf from 100 grammes of flour.	Height of loaf divided by diameter.	Form of crust.	Texture.	Inside colour.	Time of Fermentation.	
	Spring Wheats.	Grms.	Grms.	Cubic C.					Hrs.	Min.
95	Advance (Yellow)	63·5	40	526	·64	85	88	84	3	12
87	Assiniboia	62·5	38	504	·66	89	95	81	3	23
81	Aurora	62·5	38	516	·66	90	88	78	3	8
99	Colorado No. 50	61 5	41	473	·69	103	96	98	3	33
90	Gatineau	58	35	514	·70	105	95	97	3	25
88	Huron (Selected)	63	39	490	·62	88	91	89	3	9
98	Laurel	58·5	38	428	·62	90	78	95	3	24
3	Red Fife (1902)	65·5	39	550	·74	99	104	105	3	51
83	Red Fife H	65	40	538	·68	99	93	98	3	9
85	Red Fife, Soft	64	38	504	·65	80	93	99	3	20
86	Red Fife, Hard	65·5	38·5	560	·69	90	98	101	3	20
93	Red Preston	63	39	502	·66	90	93	94	3	10
84	Yellow Cross	59	36	486	·63	85	85	85	3	10
91	9 J 3	56	35	454	·62	95	80	83	2	53
	Winter Wheat.									
92	Turkey Red (Kansas)	63·5	38	550	·68	102	98	97	3	2

Baking strength and Bread Value, as determined by Baking Tests, January-March, 1906.

Milling Number.	Variety.	Where and when Grown.	Baking Strength.	Bread Value.	Remarks.
	Spring Wheats.				
95	Advance (Yellow).	Ottawa.....1905	91	89	Bread somewhat yellowish inside.
87	Assiniboia	Neepawa.....1905	91	89	Bread was rather dark inside.
81	Aurora	Ottawa.....1905	91	88	Bread rather dark inside.
99	Colorado, No. 50	Colorado	94	95	Crust rather pale. Dough would not rise very high but showed no tendency to fall.
90	Gatineau	Ottawa.....1905	95	96	Low in water absorption; crust rich brown in colour.
88	Huron (Selected)	" 1905	87	88	Shape of loaf not very good.
98	Laurel	" 1905	76	81	Low in water absorption; crust pale.
3	Red Fife	" 1902	106	106	High in water absorption; crust rather pale.
83	Red Fife H.	" 1905	99	99	High in water absorption.
85	Red Fife, Soft	Neepawa.....1905	89	91	Crust pale and not of good form.
86	Red Fife, Hard	" 1905	100	100	High in water absorption.
93	Red Preston	Ottawa.....1905	91	92	.....
84	Yellow Cross	" 1905	82	83	Gained little or no volume in oven.
91	9 J 3	" 1905	78	79	Crust colour very good, not pale; very low in water absorption.
	Winter Wheat.				
92	Turkey Red	Kansas	101	100	.....

Varieties arranged in Series according to Baking Strength, Volume of Loaf and Shape of Loaf.

Variety.	Baking Strength.	Variety.	Volume of Loaf.	Variety.	Height of Loaf divided by diameter.
Red Fife, 1902	106	Red Fife, Hard	560	Red Fife, 1902	·74
Turkey Red	101	Red Fife, 1902	550	Gatineau	·70
Red Fife, Hard	100	Turkey Red	550	Red Fife, Hard	·69
Red Fife H	99	Red Fife H	538	Colorado, No. 50	·69
Gatineau	95	Advance (Yellow)	526	Red Fife H	·68
Colorado, No. 50	94	Aurora	516	Turkey Red	·68
Advance (Yellow)	91	Gatineau	514	Assiniboia	·66
Assiniboia	91	Assiniboia	504	Aurora	·66
Aurora	91	Red Fife, Soft	504	Red Preston	·66
Red Preston	91	Red Preston	502	Red Fife, Soft	·65
Red Fife, Soft	89	Huron (Selected)	490	Advance (Yellow)	·64
Huron (Selected)	87	Yellow Cross	486	Yellow Cross	·63
Yellow Cross	82	Colorado, No. 50	473	Huron (Selected)	·62
9 J 3	78	9 J 3	454	9 J 3	·62
Laurel	76	Laurel	428	Laurel	·62

SECOND GROUP OF TABLES.

The second group of four tables gives the figures obtained during the winter of 1906-1907.

Milling tests, December, 1906.

Milling Number.	Variety.	Where and When Grown.	Weight per measured bushel.	Percentage of break flour.	Remarks.
	Spring Wheats.		Lbs.		
140	Bishop A	Ottawa 1906	58¾	13	Kernels rather hard but dull and not plump. Flour yellowish, granular.
138	Bobs	" 1906	61½	13½	Kernels rather hard, yellow, not bright. Flour pale cream colour. granular.
101	Campbell's White Chaff	" 1906	58¾	12	Kernels rather soft, not plump, not bright. Flour pale cream, rather soft.
139	Chelsea	" 1906	60½	9½	Kernels hard, red but not very bright. Flour pale cream, granular.
125	Colorado	" 1906	62	15½	Kernels soft, dull red. Flour pale cream, soft.
105	Downy Riga D.	" 1906	62½	8½	Kernels very hard, bright deep red. Flour cream colour, granular.
119	Early Russian	" 1906	62¾	14	Kernels not very hard. Flour pale, soft.
112	Ebert	" 1906	63½	9	Kernels very hard, red, rather bright. Flour yellowish, granular.
114	Gatineau	" 1906	60	12	Kernels hard, red; not plump or bright. Flour cream colour, granular.
141	Grant	" 1906	61½	10½	Kernels hard, red, but not very bright. Flour cream colour, granular.
135	Haynes' Blue Stem	" 1906	58	12	Kernels not plump, dull, rather hard. Flour cream colour, granular.
134	Herisson Bearded	" 1906	63¾	20	Kernels soft, plump, dull red. Flour cream colour, soft.
133	Hungarian White	" 1906	61½	14	Kernels not very hard. Flour pale cream, granular.
131	Huron (Selected)	" 1906	61½	11	Kernels fairly hard, not very bright. Flour cream colour, granular.

Milling tests, December, 1906—*Continued.*

Milling Number.	Variety.	Where and When Grown.	Weight per measured bushel.	Percentage of break flour.	Remarks.
			Lbs.		
108	Ladoga	Ottawa 1906	60½	11	Kernels hard, deep red, rather bright. Flour yellow, granular.
145	Laurel	" 1906	59½	16	Kernels rather soft, very dull red, not plump. Flour pale cream, soft.
129	Marquis	" 1906	61¾	11	Kernels rather hard and moderately bright. Flour pale cream, rather granular.
148	Outlook	" 1906	59	12½	Kernels rather hard but not bright or plump. Flour cream colour, granular.
120	Percy A	" 1906	60¾	10	Kernels hard; dark red in colour and rather bright. Flour cream colour, granular.
118	Preston A	" 1906	61	11	Kernels rather hard and moderately bright. Flour yellowish, granular.
126	Pringle's Champlain	" 1906	61½	13	Kernels rather hard. Flour cream colour, granular.
147	Pringle's Champlain	Indian Head. ..1906	63	.....	Kernels hard, red, bright. Flour yellowish, granular.
110	Prospect	Ottawa..... 1906	58½	14	Kernels rather soft, dull red, not plump. Flour pale cream, soft.
136	Red Fern	" 1906	60¾	12½	Kernels moderately hard, dull red. Flour cream colour, somewhat granular.
149	Red Fife	" 1902	61½	14½	Kernels rather soft but plump and moderately bright. Flour cream colour, granular.
109	Red Fife H	" 1906	59	13	Kernels rather hard, but not plump or bright. Flour pale cream, granular.
146	Red Fife	Indian Head....1906	63	.....	Kernels hard, red, rather bright. Flour granular, cream colour.
132	Red Preston	Ottawa.....1906	59½	11	Kernels hard; dark red but not very bright. Flour cream colour, granular.
143	Riga M	" 1906	60	18	Kernels rather soft and of a dull colour. Flour pale cream, rather soft.
113	Spence Yellow	" 1906	64	12	Kernels hard, yellow, rather bright, plump. Flour cream colour, granular.
106	Stanley A	" 1906	59	12½	Kernels rather soft, dull in colour, not plump. Flour pale cream colour, granular.
107	Stanley C	" 1906	60	11	Kernels hard, not very plump but moderately bright. Flour yellowish and very granular.
150	White Fife C	" 1906	60¾	13	Kernels hard, yellow, moderately bright. Flour cream colour, granular.
117	White Russian	" ..... .1906	60½	16½	Kernels rather soft and of a dull red colour Flour pale, soft.
144	Yellow Fife	" 1906	61	13	Kernels moderately hard. Flour yellowish, somewhat granular.
130	Yellow Queen	" 1906	62	14	Kernels rather soft, but plump and bright. Flour pale, soft.
	Durum Wheats.				
123	Goose	" 1906	63½	4	Kernels very hard, yellow. Flour yellow, very granular.
122	Kubanka (=Washington No. 5,639)	" 1906	63	5½	Kernels very hard, yellow. Flour yellow, very granular.
	Winter Wheats.				
102	Dawson's Golden Chaff	" 1906	61¾	17½	Kernels soft. Flour pale cream, soft.
100	Padi	" 1906	61½	21	Kernels soft, pale red but bright. Flour pale cream, soft.
104	Tasmania Red	" 1906	62	15	Kernels large, soft. Flour pale cream, somewhat granular.
103	Turkey Red (No. 380)	" 1906	63¾	14	Kernels plump, rather soft. Flour cream colour, granular.
151	Turkey Red	Lethbridge, Alberta, 1906	64½	11½	Kernels plump, hard, red, bright. Flour cream colour, granular.

In addition to the samples of flour made in December, 1906, baking tests were carried on (in January and February, 1907) with three different kinds of commercial flour and also with a small quantity of the flour from Yellow Cross wheat, milling No. 84, which had been tested the previous winter. This latter flour was placed in a glass stoppered bottle in March, 1906, and kept over in that way. In January, 1907, it was transferred to a paper bag and was kept for some time with the new samples of flour before being baked. The results of the baking tests with these four kinds of flour will be found at the end of the table.

BAKING TESTS, January-February, 1907.

Milling Number.	Variety.	Water added to 100 grammes of flour.	Water retained by 100 gramme of flour.	Volume of loaf from 100 grammes of flour.	Height of loaf divided by diameter.	Form of crust.	Texture.	Inside colour.	Time of fermentation.	
	Spring Wheats.	Grms.	Grms.	Cubic C.					Hrs.	Min.
140	Bishop A	59	37·5	488	·67	96	93	89	2	50
138	Bobs	59·5	36	517	·70	91	102	101	3	5
101	Campbell's White Chaff	58	37	485	·70	88	98	93	3	33
139	Chelsea	61	38·5	524	·72	94	101	101	3	14
125	Co orado	56·5	36	422	·67	92	78	95	3	30
105	Downy Riga D	62	42	419	·61	97	82	97	2	53
119	Early Russian	60	39	511	·73	95	99	102	3	7
112	Ebert	61	41	375	.53	80	75	88	3	..
114	Gatineau	58	36	534	·69	94	98	98	3	16
141	Grant	61	41·5	372	·57	81	74	97	2	53
135	Haynes' Blue Stem	60	36·5	546	·71	96	100	100	3	8
124	Herisson Bearded	58	39	434	·69	99	84	83	3	29
133	Hungarian White	60·5	37	528	·72	92	101	100	3	11
131	Huron (Selected)	59·5	39	429	·64	97	86	85	3	11
108	Ladoga	57	37·5	418	·61	96	79	77	3	4
145	Laurel	56	36	417	·64	90	83	96	3	36
129	Marquis	61	39	523	·70	93	101	100	3	6
148	Outlook	60	37	537	·70	97	101	99	3	5
120	Percy A	61	41	429	·66	94	85	96	3	33
118	Preston A	60	40	438	·66	91	90	84	3	23
126	Pringle's Champlain	61·5	39·5	501	·67	90	97	96	3	10
147	Pringle's Champlain (I.H.)	58	38	445	·60	91	88	95	2	52
110	Prospect	59	38	469	·72	97	87	99	3	23
136	Red Fern	57·5	34·5	535	·70	95	100	99	3	10
149	Red Fife (1902)	62·5	39	570	·73	98	105	105	3	18
109	Red Fife H	62	38	567	·69	96	101	101	3	1
146	Red Fife (I.H.)	58	35·5	532	·67	98	99	100	3	11
132	Red Preston	61	41	445	·62	91	87	94	3	4
143	Riga M	57	37	407	·64	95	79	90	3	47
113	Spence Yellow	58·5	40·5	438	·60	83	78	99	2	55
106	Stanley A	61.5	40·5	454	·65	91	94	101	3	15
107	Stanley C	57·5	36	505	·65	93	94	80	3	3
150	White Fife C	59	36.5	559	·68	96	102	100	3	9
117	White Russian	59·5	40	434	·66	91	85	101	3	2
144	Yellow Fife	59	37	495	·65	93	91	86	3	6
130	Yellow Queen	60	40	443	·68	91	84	99	3	52
	Durum Wheats.									
123	Goose	61·5	41	435	·64	90	83	78		..
122	Kubanka	59·5	39	530	.69	98	101	78	3	33
	Winter Wheats.									
102	Dawson's Golden Chaff	56	34	436	·62	78	91	101	3	25
100	Padi	58	37	470	·71	90	96	78	3	28
104	Tasmania Red	60·5	39·5	489	·68	93	99	100	2	57
103	Turkey Red (No. 380)	64	40	519	·68	91	102	103	3	4
151	Turkey Red (Alberta)	60	37	487	·64	83	97	98	3	15

Baking tests, January-February, 1907—*Continued.*

Milling Number.	Variety.	Water added to 100 grammes of flour.	Water retained by 100 grammes of flour.	Volume of loaf from 100 grammes of flour.	Height of loaf divided by diameter.	Form of crust.	Texture.	Inside colour.	Time of fermentation.	
	Milled January, 1906.	Grms.	Grms.	Cubic C.					Hrs.	Min.
84	Yellow Cross	62	39·5	559	·70	93	100	95	2	50
	Commercial Flours.									
	'Monarch'	55·5	34·5	448	·63	90	90	.....	3	23
	'Queen City'	58	37	487	·67	94	96	.....	3	27
	'White Clover'	64·5	43	500	·67	87	101	.....	3	16

Baking strength and Bread Value, as determined by Baking Tests, January and February, 1907.

Milling Number.	Variety.	Where and when Grown.	Baking Strength.	Bread Value.	Remarks.
	Spring Wheats.				
140	Bishop A	Ottawa 1906	90	90	Crust somewhat dark brown.
138	Bobs	" "	98	99	Texture of loaf extra good.
101	Campbell's White Chaff	" "	91	92	Crust pale.
139	Chelsea	" "	99	99	Crust rich brown.
125	Colorado	" "	77	81	Low in water absorption. Dough had a decided tendency to fall during fermentation.
105	Downy Riga D	" "	80	84	High in water absorption, but low in volume and poor in shape.
119	Early Russian	" "	98	99	Loaves excellent in shape.
112	Ebert	" "	65	68	Very low in volume and poor in shape and texture.
114	Gatineau	" "	96	96	Crust rich brown. Excellent bread.
141	Grant	" "	57	67	Very low in volume and poor in shape and texture.
135	Haynes' Blue Stem	" "	100	100	.....
134	Herisson Bearded	" "	84	84	Good bread but unattractive in colour inside.
133	Hungarian White	" "	98	99	.....
131	Huron (Selected)	" "	82	83	.....
108	Ladoga	" "	75	76	Dough had a decided tendency to fall during fermentation.
145	Laurel	" "	76	81	Low in water absorption.
129	Marquis	" "	98	98	.....
148	Outlook	" "	99	99	.....
120	Percy A	" "	83	86	Crust of a rich brown colour. Bread of very good quality.
118	Preston A	" "	84	84	.....
126	Pringle's Champlain	" "	93	94	.....
147	Pringle's Champlain	Indian Head "	80	84	.....
110	Prospect	Ottawa "	89	91	Crust pale.
136	Red Fern	" "	96	97	Excellent bread.
149	Red Fife	" 1902	107	106	High in water absorption and in volume Texture extra good.

Varieties arranged in Series, according to Baking Strength, Volume of Loaf and Shape of Loaf.

Variety.	Baking strength	Variety.	Volume of oaf.	Variety.	Height of loaf divided by diameter.
Red Fife, 1902	107	Red Fife, 1902	570	Red Fife, 1902	·73
Red Fife H.	102	Red Fife H.	567	Early Russian	·73
Yellow Cross, 1905	102	Yellow Cross, 1905	559	Chelsea	·72
Haynes' Blue Stem	100	White Fife C	559	Hungarian White	·72
White Fife C	100	Bobs	547	Prospect	·72
Chelsea	99	Haynes' Blue Stem	546	Haynes' Blue Stem	·71
Outlook	99	Outlook	537	Padi	·71
Kubanka	99	Red Fern	535	Bobs	·70
Bobs	96	Gatineau	534	Campbell's White Chaff.	·70
Early Russian	98	Red Fife (I.H.)	532	Marquis.	·70
Hungarian White	98	Kubanka	530	Outlook	·70
Marquis	98	Hungarian White	528	Red Fern	·70
Turkey Red (No. 380)	98	Chelsea	524	Yellow Cross, 1905	·70
Gatineau	96	Marquis	523	Gatineau	·69
Red Fern	96	Turkey Red (No. 380)	519	Herisson Bearded	·69
Red Fife (I.H.)	95	Early Russian	511	Red Fife H	·69
Pringle's Champlain	93	Stanley C	505	Kubanka	·69
Tasmania Red	93	Pringle's Champlain	501	White Fife C	·68
Campbell's White Chaff.	91	Yellow Fife	495	Yellow Queen	·68
Bishop A	90	Tasmania Red	489	Tasmania Red	·68
Prospect	89	Bishop A	488	Turkey Red (No. 380)	·68
Stanley C	89	Turkey Red (Alberta)	487	Bishop A.	·67
Padi	89	Campbell's White Chaff.	485	Colorado	·67
Yellow Fife	88	Padi	470	Pringle's Champlain	·67
Stanley A	87	Prospect	469	Red Fife (I.H.)	·67
Turkey Red (Alberta)	87	Stanley A	454	Percy A	·66
Herisson Bearded.	84	Red Preston	445	Preston A.	·66
Preston A	84	Pringle'sChampl'in(I.H.)	445	White Russian	·66
Yellow Queen	84	Yellow Queen	443	Stanley A	·65
Percy A	83	Preston A	438	Stanley C	·65
Red Preston	83	Spence Yellow	438	Yellow Fife	·65
Huron (Selected)	82	Dawson's Golden Chaff.	436	Huron Selected	·64
White Russian	82	Goose	435	Laurel	·64
Goose	81	Herisson Bearded	434	Riga M	·64
Downy Riga D	80	White Russian	434	Goose	·64
Pringle'sChampl'in(I.H.)	80	Percy A	429	Turkey Red (Alberta)	·64
Colorado	77	Huron Selected	429	Red Preston	·62
Laurel	76	Colorado	422	Dawson's Golden Chaff.	·62
Spence Yellow	76	Downy Riga D	419	Downy Riga D	·61
Dawson's Golden Chaff.	76	Ladoga	418	Ladoga	·61
Ladoga	75	Laurel.	417	Pringle's Champ'n(I.H.)	·60
Riga M.	75	Riga M	407	Spence Yellow	·60
Ebert	65	Ebert	375	Grant	·57
Grant	57	Grant	372	Ebert	·53
White Clover	96	White Clover	500	White Clover	·67
Queen City	90	Queen City	487	Queen City	·67
Monarch	80	Monarch	448	Monarch	·63

NOTES ON SOME VARIETIES OF WHEAT.

Some remarks on a few of the most important varieties of wheat mentioned in the foregoing tables may be of interest.

VARIETIES TESTED 1905-1906.

Assiniboia.—This is the common bearded wheat with red chaff, usually found mixed with Red Fife in the western fields. It should be noted that the flour obtained from this wheat was of good strength although distinctly inferior to that produced by Red Fife wheat of equal hardness. The yellow colour of the flour is another point of inferiority.

Red Fife.—The two samples grown near Neepawa, Man., were subjected to essentially the same climatic conditions, but the soft wheat was grown as the second crop after the breaking of 'scrub' land, that is, land which had been covered with a growth of shrubs and trees; while the hard wheat was grown on a field which had been cultivated for some years and which had been in Timothy sod the previous season. The Red Fife H is an early strain multiplied from a single selected plant. The Red Fife of 1902 represents the ordinary crop obtained from the plot grown at Ottawa in that season. It no doubt owes its high baking strength partly to age. It is interesting to notice that the Red Fife H grown at Ottawa is only one mark for strength behind the hard Red Fife grown at Neepawa.

Red Preston.—This is a selected strain obtained from Preston wheat and possessing red chaff as well as red kernels. It gives flour of good colour and in the tests under consideration it showed a strength slightly greater than that of soft Red Fife, although distinctly less than that of any sample of Red Fife of equal hardness.

Turkey Red.—The flour from this sample was of very good strength although the wheat itself was unattractive. The age of this wheat is, however, uncertain. Its very high strength may be partly due to age.

VARIETIES TESTED IN 1906-1907.

Attention is called to the following varieties all of which produced flour of high strength:—

Bobs.—This wheat was received from the late Mr. William Farrer of Australia. It is rather early in ripening and is said to resist rust very well in some parts of Australia.

Chelsea and *Marquis* are new cross-bred sorts produced at the Central Experimental Farm. They both resemble Red Fife rather closely but are distinctly earlier in ripening.

Early Russian is a selected strain of wheat produced by the writer from a sample of Russian origin, supposed to be the variety called Ghirka. It resembles, in many ways, White Russian but is earlier and produces flour of much greater strength.

Gatineau is from a cross, made by the writer, between Red Fife and Goose wheat. It combines many of the good qualities of the two parents and, though not an early variety, may prove of value in dry districts where the season is fairly long.

Haynes' Blue Stem.—This is a selected type of Blue Stem which was sent to the Central Experimental Farm from the Minnesota Agricultural Experiment Station under the designation Minnesota No. 169. It is rather too late in maturing to be quite satisfactory in most parts of Canada.

Outlook is a new variety produced by the writer by crossing Red Fife with Rideau, an early sort which was itself a Red Fife cross.

Hungarian White.—This is a rather early, bearded wheat obtained from Germany. It may prove of great value if not found too susceptible to rust.

Red Fern.—As will be seen this old variety takes a high rank for flour strength, and indeed the bread produced from it surpassed in quality, according to the writer's opinion, that made from almost all of the other sorts.

White Fife C is a selected strain of White Fife which is, however, not strikingly different from ordinary pure White Fife. It is practically identical in all respects with Red Fife except in regard to the colour of the bran which is yellow.

In addition to the wheats just mentioned, which are of interest on account of the strength of their flour, attention should be drawn to some well-known varieties which are of rather low strength and are therefore not suitable for the production of extremely light bread or for export to countries desiring strong flour. The well-known sorts Colorado, Herisson Bearded and White Russian (the latter being practically identical with Wellman's Fife, Monarch, McKendry's Fife, Minnesota No. 181 and Minnesota No. 163) all fall in this group.

Ladoga wheat produced flour of distinctly weak character, and it is noteworthy that most of the varieties produced by crossing Ladoga with Red Fife showed a baking strength which is about midway between the two parents.

Pringle's Champlain.—This is one of the rather promising early wheats which are now being tested in different parts of the North-West provinces. Although it only showed medium strength as grown at Indian Head, the sample grown at Ottawa gave decidedly strong flour.

Red Fife.—Of the two samples examined this year that grown at Ottawa showed decided superiority in baking strength over that grown in Saskatchewan, although as may be seen by reference to the second part of this bulletin the Saskatchewan sample contained a larger proportion of gluten.

Stanley.—The two selected strains of this variety, under the letters A and C, are of rather particular interest, as they were commenced some years ago by the selection of two heads, some of the kernels of each of which had been tested by the method of chewing already described. The gluten in A was considered much superior to that in C and of distinctly better colour. This difference was observed every season, and when the amount of wheat on hand was sufficient for a baking test, the essential accuracy of the conclusions drawn from the chewing was shown. Stanley A gives flour of very good colour, and although, as may be seen by reference to the chemical analysis, it does not contain nearly so much gluten as Stanley C, nevertheless, the baking strength of A is almost equal to that of C, and when the question of colour is brought into consideration, A ranks distinctly above C. Better results are expected from A in other seasons, as it was not grown beside C in 1906, and appeared to suffer somewhat from the unsuitability of the soil conditions, the sample being much inferior in appearance to C. A peculiarity of Stanley C to which considerable weight must be given, should be mentioned. The dough produced from this variety, although able to give bread of very good volume, has so strong a tendency to spread over the sides of the tin that only a very small quantity of water can be added, the dough being therefore very stiff, so stiff indeed that this flour would be extremely unpopular among bakers. By referring to the tables, it will be seen that Stanley A absorbed and retained about 4 per cent more water than Stanley C, in spite of the fact that it contained a much smaller quantity of gluten. Stanley A also showed scarcely any tendency to spread. It is clear, therefore, that the gluten in this strain is much superior to that in the other. So many considerations, however, enter into the determination of baking strength that the valuable indications obtained from the chewing test need confirmation by actual baking trials.

Durum Wheats.—The two Durum wheats examined, show conclusively that the common custom of regarding these as all of one quality is absurd. They are often spoken of as 'Macaroni' or 'Goose' wheats, as if they were all the same as Goose wheat, and useful only for the making of edible pastes. While the ordinary Goose (or Wild Goose) cannot be recommended for bread-baking, the Kubanka produced admirable bread, which, however, differs in some ways from that produced from most of the other wheats. The Kubanka dough must be made rather stiff in order that it may not be too sticky to handle conveniently. It rises very well, producing a large loaf of very fine texture and of good form. The crust is somewhat unusual, being of a

rich brown colour and having a tendency to be thin and tough. The inside colour of the bread is quite yellow, but this gives an appearance of richness and can only be objected to on the grounds of prejudice. Taking all its characteristics into consideration, I have no hesitation in saying that the bread produced from this sample of wheat was of excellent quality.

Winter Wheats.—Among winter wheats Dawson's Golden Chaff may be mentioned as a variety rather low in strength but producing good bread of pale appearance and rather compact character. Padi seems unworthy of general cultivation, especially on account of the peculiar greenish-yellow colour of the inside of the loaf, which is all the more remarkable when compared with the very pale character of the crust. The two samples of Turkey Red are of interest from many points of view, and serve to show the strength of this wheat as grown at Ottawa. The Ottawa sample is a selected, pure strain obtained originally, under the number 380, from the Kansas State Agricultural Experiment Station. The Alberta sample was obtained in commerce and may not have been strictly pure.

COMMERCIAL FLOURS.

The three kinds of commercial flour studied were obtained from Canadian mills, The samples were all kept for some time under uniform, dry conditions before being tested, and no doubt held less moisture when the baking tests were made than they would contain as ordinarily found in commerce. 'Monarch' is a flour made from Ontario winter wheat. 'Queen City' is a mixture containing flour from Ontario winter wheat and Northwestern spring wheat. 'White Clover' is made entirely from Northwestern spring wheat. Although there is some doubt as to the exact age of the wheats used in the production of these flours, and though none of them represents a single variety only, it is interesting to notice that, in regard to baking strength, they stand in the order which would be expected, the 'Queen City' coming almost exactly midway between the other two. Not only is this true in regard to baking strength (the summing up of the various properties of the flours), but it is true also in regard to nearly all the details noted in the tables. Of these three flours 'Monarch' was found to be much the best for the production of pastry and cakes, 'White Clover' the best for the making of very light bread (being also highest in water absorption) while 'Queen City' occupied an intermediate position, representing what may be termed general purpose flour.

INFLUENCE OF AGE ON WHEAT AND FLOUR.

It is generally admitted that wheat improves in quality for some time after being harvested and that age has also a beneficial effect on the colour and strength of flour. There are however differences of opinion on these matters, especially as to the length of time during which improvement takes place. Some writers claim that deterioration begins in flour, in regard to strength at any rate, before a very long period of time has elapsed. The experimental evidence in support of any of these opinions is fragmentary and so very unsatisfactory that the whole subject needs much further work of a more thorough character, before any trustworthy conclusions can be drawn.

In the present investigation great care has been taken to compare as a rule only such flours as were of the same age and made from wheat of the same harvest and kept under similar conditions. The question of the effect of age is of such great importance that the writer hopes to give considerable attention to it in the near future. Up to the present he has only been able to touch the subject in one or two ways. There are however a few interesting facts mentioned in the preceding tables to which attention may be called. It is noteworthy that the Red Fife wheat grown at Ottawa in 1902 and made into flour in 1904, stands much higher in the baking tests of 1906 than any other variety examined. In 1907 the same wheat is again at the head, the flour in this instance

having been produced in December 1906. There appears to have been a slight improvement between January 1906 and January 1907, but this is probably quite within the limits of the possible experimental error. One may certainly say, however, that the flour is fully maintaining its remarkable strength, although the wheat, at the time of the last baking tests was about four and a half years old. While it is possible that the extremely high rank of this wheat may be due in part to some peculiarly favourable conditions of the season of 1902, it is probable that it has been brought about partly by improvement due to age.

A still more striking instance is that of Yellow Cross wheat. This new cross-bred variety was milled and baked in midwinter 1906, being than about six months old. It showed a rather low baking strength (82) and was, therefore, considered undesirable for bread-making. However, as the variety had some claims to attention on account of its possible suitability for the production of rolled wheat, it was not rejected from our experimental plots, and a sample of the flour was kept over until the next winter. When the baking tests were carried out the second time (1907), it was found that an astonishing improvement in strength had taken place during the twelve months, 102 being the mark earned for baking strength at the second series of tests. It will be seen on carefully comparing the figures obtained in the two years that the flour improved in every respect, taking up a larger amount of water, retaining more, giving a loaf of larger volume and of better shape, crust, texture and colour. The behaviour of the dough in the oven was most remarkable. While in the first tests, with a water absorption of 59 per cent the dough had a tendency to fall, after the twelve months' keeping, although the water was increased to 62 per cent, the dough had the ability to rise to a most remarkable degree when put into the oven. The sample of flour was kept for the twelve months under dry conditions in a glass-stoppered bottle. It would appear that this astonishing change in baking strength must have been due to an improvement in the quality of the gluten, as it could scarcely be explained on any other supposition. If further tests should show that the baking strength of this wheat can always be raised to approximately 102 by keeping it over for one year, it may prove very valuable for some sections of our country.

VARIATIONS IN FLOUR STRENGTH DUE TO SOIL AND CLIMATE.

A few determinations of the strength of flour have been made upon the same varieties grown under different conditions. In the first table three samples of Red Fife are mentioned. That under the designation of Red Fife H is an early strain of fine quality selected at the Central Experimental Farm. The other two samples, designated Red Fife Soft and Red Fife Hard, were collected near Neepawa, Man., the hard sample being such as would have been graded Extra No. 1 Hard and the soft one, consisting almost entirely of soft kernels, would have been graded no doubt as low as No. 3 Northern. In both cases, I picked all the heads and threshed the grain myself so as to be sure of its purity. These two samples were of course quite extreme and represented almost the maximum of hardness and softness possible in this variety. The only conspicuous difference noticed when grinding the three samples was that the soft Red Fife produced about half as much break flour again as either of the others. The baking tests, however, showed very great differences, the Red Fife H having a baking strength of 99, the soft Red Fife 89 and the hard Red Fife 100. The inferiority of the soft Red Fife was noticeable in almost every respect in which the flours were compared. It is interesting to observe that the Ontario grown sample, though considerably inferior in appearance to the hard sample from Manitoba, produced flour practically equal in quality. These tests show clearly that great differences in baking strength are found when samples of the same variety are examined which differ radically in hardness, the softer wheat giving weaker flour. When such variations as these occur, it is plain that we cannot make any rigid classification of varieties of wheat into hard and soft, although it is true that some sorts have more tendency than others towards hardness or softness.

Some other comparisons between Ontario wheats and those grown further west may be of interest. Red Fife grown at Indian Head, Sask., in 1906, though showing greater weight per bushel and superior hardness and brightness, produced flour having a baking strength of only 95 as compared with 102 earned by the Red Fife H grown at Ottawa. While it is true that the Ottawa sample is a selected strain, I do not think that the whole of this difference can be attributed to that fact alone. By reference to the second part of this bulletin, it will be seen that the Indian Head sample was distinctly richer in gluten than that grown at Ottawa. In this case increased gluten content does not imply increased baking strength.

The variety known as Pringle's Champlain gives another interesting opportunity for comparisons. The Ottawa sample earned thirteen marks for strength more than that grown at Indian Head, though the former weighed only 61½ lbs. per bushel while the latter weighed 63.

Among the winter wheats, it will be noticed that the Turkey Red grown at Ottawa in 1906, surpassed by eleven marks that grown the same season near Lethbridge in southern Alberta. In this case, however, we are dealing with a selected Turkey Red as compared with a commercial sample which may not be strictly pure. This difference in breeding and purity may account for part of the superiority of the Ottawa wheat.

It is interesting to compare the results obtained when one variety has been examined for two successive seasons from the same farm. In such cases it is customary to say that the samples have been grown in the same kind of soil and climate. This is, however, quite inaccurate as it is impossible on most farms to obtain two pieces of land of exactly the same character, and, besides, each season has its own peculiarities. Indeed not only is the climate different every year, but even in one season different varieties in the same field are subjected to different climatic conditions. For instance, if many days of hot, dry weather occur lasting just long enough to ripen a very early variety and then the weather suddenly changes and remains wet and cool until the later maturing varieties are ripe, in such a case it is obvious that the early ripening varieties can fairly be said to have matured in an entirely different type of season or climate from that in which the later sorts were ripened. The expression 'uniform soil and climate,' should, therefore, always be understood in a very rough and crude sense only. Referring to the tables, it may be noticed that Gatineau earned one more mark for baking strength the second season than the first. Huron Selected and Red Preston earned several marks less the second season than the first. Laurel had the same mark both seasons, while Red Fife H showed a gain of three marks in the second season. These instances are too few to enable one to draw any conclusions of importance, except that the average baking strength of any variety of wheat cannot be established by the examination of one sample. What may be the greatest limits of variation possible between different samples of the same variety in different seasons or in different climates, it is impossible to say. The baking strength of the samples of Red Fife studied varied from 89 to 102 considering only the wheat of the current season. But if the old samples are considered also the limits of variation are still greater.

APPEARANCE NOT A TRUSTWORTHY INDICATION OF QUALITY.

Although as has just been shown, very hard Red Fife may be expected to give stronger flour than soft Red Fife, and no doubt as a general rule two samples of the same variety differing in hardness will also differ in the strength of flour produced from them, nevertheless, when comparing different samples of unknown varieties, very little value indeed is to be attached to their relative hardness or softness. Sometimes the softer sample will yield the stronger flour. Soft Red Fife, for instance, gave stronger flour than Huron Selected, which was a hard wheat, and Tasmania Red (soft) produced much stronger flour than Ebert (hard). Reference to the tables will reveal many cases of wheats of about equal hardness which yielded flours quite different in

strength. A similar uncertainty pertains to the other characteristics by which wheat is usually judged. It is not always true, as very commonly supposed in some sections of Canada, that a dark red wheat with a bright skin is good for the production of strong flour. Some wheats with a yellow skin (Bobs, White Fife, Kubanka) give distinctly stronger flour than others, which have a red skin, and some of the dark wheats (Assiniboia, Aurora, Downy Riga, Ebert) are by no means in the first rank for strength. There is no doubt some justification for the preference of bright samples of grain, that is, those which are free from blemishes, usually caused by frost or rain; but it is quite uncertain in many cases to what extent the actual quality of the interior of the kernel has been lowered when there is evidence of injury to the bran. It is often highly probable that the interior of the berry is in essentially perfect condition even though the bran may be dull and unattractive.

For further confirmation of some of the statements just made, attention is drawn to a few of the most striking instances in the preceding tables. Among the samples tested in the winter of 1905-1906, should be noticed Assiniboia, the kernels of which were rather hard and plump and of a bright, deep red colour. This sample may be compared with Colorado No. 50 (a variety quite distinct from the ordinary Colorado), the kernels of which were rather soft and of a dull yellow colour but which produced flour three points better in baking strength than the Assiniboia. Red Fife H was eight points better than Assiniboia though the kernels were not so plump or bright. Still more striking examples of the untrustworthiness of the appearance of wheat as an indication of its quality are found in the tables dealing with the wheats studied in the winter of 1906-7. Among the weakest samples of flour obtained may be mentioned those from Downy Riga D which had very hard kernels of a bright, deep red colour, Ebert which had very hard kernels of rather a bright colour, Grant which had hard red kernels not very bright in colour, and Ladoga the kernels of which were hard, deep red and rather bright. On the other hand, very strong samples of flour were obtained from Bobs, the kernels of which were rather hard but of a yellow colour and not bright, from Early Russian, the kernels of which were not very hard or bright, from Gatineau which had hard, red kernels, not plump or bright, from Haynes' Blue Stem with rather hard kernels which were not plump and were dull in colour, from Red Fern which had moderately hard, dull red kernels, from Red Fife H, which though rather hard, was not plump or bright, and from White Fife C and Kubanka, both of which had yellow skin.

The tables also make it clear that different samples of the same variety, though somewhat similar in appearance, may differ considerably in flour strength when they have been grown in different parts of the country. The two samples of Pringle's Champlain, Nos. 126 and 147, illustrate this very well. Though they are much alike in appearance the sample No. 147 would be considered by most buyers as superior to the other; but from a baker's point of view it is actually much inferior.

The prejudice in Canada in favour of dark wheats is very strong. It is true that a pale colour due to starchiness of the kernel is often an indication of lack of strength in the flour, but when the pale tint is only in the bran there is no reason (unless the sample is weathered) to suppose that the wheat in question will yield flour of lower strength than a darker sample. Natural paleness in the bran is no indication at all of weakness in the flour. It is strange that wheat buyers and others who are interested in the valuation of wheat seem so often to be unable to perceive the difference between paleness due to a pale skin and paleness due to a pale interior of the kernel.

Though not exactly pertinent to the subject under consideration, attention is called to another common but erroneous opinion in regard to wheats: namely that early-ripening spring varieties are usually soft. This idea seems to have no foundation whatever. The following hard wheats mentioned in the foregoing tables are of early-ripening habit: Aurora, Chelsea, Downy Riga, Ebert, Ladoga, Percy, Preston and others.

MIXED FLOURS.

As some investigators have reported rather peculiar results obtained by the mixing of flours, the baking strength of the mixture being in some cases quite different from the mean between the two flours employed, it seemed important to make a few tests with mixtures of some of the flours mentioned in the preceding tables. Seven different mixtures were tried. In no case, however, did the tests prove of any special interest, the mixed flours giving results when baked which were very close to the mean between the two flours mixed. Each of the mixtures studied contained two kinds of flour in equal proportions. The most interesting of these was a mixture of Red Fife H and Ladoga. The flour produced by mixing these two samples was strikingly like that made from the wheats (Preston, Stanley, Huron and Percy) obtained by crossing Ladoga with Red Fife or White Fife. The observations on the four cross-bred wheats mentioned show that their baking qualities are, as a rule, intermediate between those of the two parents. This will be clearly seen by a study of the tables. While it is no doubt possible that in some cases a cross-bred wheat may possess baking qualities the same as those of one of the parents, the results given here seem to show conclusively that baking strength is not a Mendelian character, that is to say, is not always inherited from one or the other parent in pure condition. It should be mentioned that the various strains of cross-bred wheats reported upon in these tables were all of quite fixed character and cannot, therefore be regarded in any sense as mixtures.

VARIATIONS IN THE METHODS OF BREAD-MAKING.

Inasmuch as there is no standard method for the making of bread and since the system employed by the writer involves the use of a larger proportion of yeast and a somewhat higher temperature for fermentation than are usual, it seemed a matter of importance to determine whether the strength of flour as ascertained by this method would remain essentially the same when the dough was treated in other ways. The following modifications were therefore tried: The first period of fermentation was in some cases made shorter by allowing the dough to rise to a smaller volume than that regularly required. This change did not make any appreciable difference in the quality of the bread. Tests were also made by omitting altogether the second kneading and putting the dough, when first mixed, immediately into the baking tin. This, as was anticipated, produced bread of inferior quality. Another modification was made by the introduction of another kneading, after the usual second kneading, the dough not being required to rise quite so high during the second period as during the first. This prolonged fermentation did not make very much difference in the quality of the bread. Variations in the amount of yeast used were also tried. The quantity employed for each loaf varying from ·6 grammes to 1·8 grammes of moist yeast. These changes did not seriously alter the figures obtained for the baking strength of the flour. Some of these tests with different quantities of yeast were conducted at a fermenting temperature of 29 to 30 degrees centigrade (84 to 86 degrees Fahrenheit) in place of the usual heat.

None of the variations introduced into the method of bread-making caused any improvement in the quality of the product, and none of them seemed to seriously alter the relative rank of the different flours. It may, therefore, be safely concluded that the figures for baking strength given in the tables are an expression of absolute fact, which, though no doubt subject to slight modification according to the methods of treatment of the dough, would, nevertheless, hold essentially true for most or perhaps all of the systems of making bread which are in common use.

TEA BISCUITS.

It seemed worth while before closing the investigations into the quality of the samples of flour to make a few tests with them to ascertain their suitability for the

production of tea biscuits. The term tea biscuit, it may be explained, is commonly used in Canada to signify small cakes made from wheat flour, usually unsweetened, but generally containing a certain quantity of butter or lard. In order to make the biscuits rise some kind of baking powder is used or else some form of sour milk with baking soda. It is almost needless to add that these cakes are not cooked twice as their name would seem to signify.

Baking Powder.—For use in these tests baking powder was prepared according to the following formula:—

Sodium bicarbonate	24·35	grammes
Potassium bitartrate	55·65	"
Corn starch	20·00	"
	100·00	"

These three ingredients were thoroughly dried before being weighed and were subsequently intimately mixed. After some preliminary tests had been made and the general practice in regard to the use of baking powders had been considered, the amount of this powder decided upon as the best was 1·8 grammes to 50 grammes of flour. The method of procedure was as follows: 50 grammes of flour were taken and to 45 grammes of this ·6 grammes salt and 1·8 grammes baking powder were added. After thoroughly mixing, 4 grammes of butter and 4 grammes of lard were added and thoroughly worked in. Finally the necessary amount of water was added, being stirred in very quickly, and the dough, which was quite sticky, was immediately removed to a plate covered with the remaining 5 grammes of flour. It was then rolled out to about three-quarters of an inch in thickness, cut into the desired shapes and at once put into the oven, where it remained at a temperature of about 240 degrees centigrade (464 degrees Fahrenheit) for about fifteen minutes. The quantity of water necessary was found to be usually about 10 per cent more than that required for the production of bread. In the process of baking, the tea biscuits usually rose to between two and two and a half times the height of the dough when put in the oven.

It is unnecessary to give the details of these experiments. All the flours tested produced biscuits of about the same volume and though they differed somewhat in character and considerably in colour, the differences were not so striking as those observed in the bread. It appears that almost any flour will make tea biscuits of fair quality. The experiments show that the flours tested had sufficient strength of gluten to attain the necessary volume when the gluten had not been subjected to the prolonged influence of the yeast fermentation, and when the quantity of gas evolved was not very large. For it must be borne in mind that even a well-made tea biscuit has a small volume compared with that of a very light loaf of bread produced from the same quantity of flour. In spite of the similarity in conduct of the various flours, under the conditions just mentioned, it is clear that one is not justified in concluding either that the gluten of all flours is practically identical or that the volume of a light loaf of bread is determined primarily by the quantity of gas evolved. The making of ordinary tea biscuits cannot be considered a test of the ability of gluten to withstand fermentation or of its power to retain a large quantity of gas produced inside the dough.

CONCLUSION.

In closing, it may not be out of place to state that the whole of the work reported upon in Part I. of this bulletin has been done by the writer himself without any assistance whatsoever. It is hoped that in this way the errors due to that uncertainty commonly known as the 'personal equation,' have been reduced to a minimum, though of course they cannot have been entirely avoided.

PART II.

THE RELATIONSHIP OF COMPOSITION TO BREAD-MAKING VALUE.

By Frank T. Shutt, M.A., F.I.C.,

Chemist, Dominion Experimental Farms.

In submitting to chemical analysis the flours discussed in Part I., it was hoped that the data so obtained might throw some further light on the relationship of the composition of a flour to its bread-making value. This problem is by no means a new one; it has been attacked by chemists in both hemispheres, more especially during the past twenty years, but up to the present time its satisfactory and complete solution has eluded the skill of the analyst. To bakers and those engaged in the flour trade it is unnecessary to say anything by way of emphasis regarding the practical value that chemical data would have, provided such data could be correlated with 'strength' or bread-making qualities. For, incomplete as our present laboratory methods are, they furnish results of considerable value in the general or broad classification of flours, if failing to distinguish between examples of approximately the same strength. In the testing of flours small quantities of which only are available (as in the early stages of much experimental work in the cross-breeding and selection of wheats) the importance of a perfected chemical scheme that would give data translatable at once into terms of 'strength', would be still greater.

It has been generally acknowledged for a number of years past that the quantity and nature of the nitrogenous compounds constitute the chief determinative factors in the examination of flours as to their relative values for bread-making. These compounds are known chemically under the collective terms protein, proteids or albuminoids, and their percentage is ascertained by multiplying the percentage of nitrogen analytically obtained by the factor 5·7. By mechanical separation, namely, by kneading the dough under a stream of water, thus washing away the starch, the well-known substance 'gluten,' which consists of the water-insoluble proteids, is obtained. It has been almost universally held that flours possessing a high percentage of protein, say, 11 per cent or over, with a gluten that is elastic, resilient and capable of retaining a large amount of water, will produce more bread, and that of a better quality, than flours containing a low protein-content (less than 11 per cent) or the gluten of which is flaccid, non-resilient and sticky.

THE NATURE OF GLUTEN.

Gluten has been shown to consist essentially of two substances—gliadin and glutenin—and it has been asserted that the quality of the flour for bread-making is determined by the proportion which the gliadin bears to the glutenin, or, again, by the total gliadin present. From this standpoint certain standards or limits have been suggested by which flours could be classified. Thus, Snyder, of the Minnesota Experiment Station. in 1904, said that in flour of good quality from 55 to 65 per cent of the protein should be in the form of gliadin. And in the year following (1905) the same author wrote: 'as our work on this point extends over a number of years it appears that it is more a question of total gliadin than the ratio of gliadin to glutenin,' but so far as the writer is aware the amount of this constituent so desired has not been stated.

In bulletin No. 50 'Grades of Wheat' (Experimental Farms Series) published in June, 1905, we pointed out that our work to that date had shown that these standards were not strictly applicable, at any rate to the flours under investigation in the Farm Laboratories. Further research during the seasons of 1906 and 1907 makes it appear as extremely doubtful if the 'gliadin number' (percentage of albuminoids in the form of gliadin) constitutes a factor that can be correlated with bread-making values as obtained by baking trials.

COMPONENTS OF FLOUR INLUENCING STRENGTH.

Quite recently an entirely new view has been advanced by Mr. T. B. Wood, of the University of Cambridge, in a paper entitled: 'The Chemistry of Strength of Wheat Flour,' and published in the Journal of Agricultural Science, Vol. II., Part 2, April, 1907. Accepting the definition of Humphries and Biffin (*) that strength is 'the capacity of making large and well-piled loaves,' and leaving out of consideration, as a distinct quality, the power of absorbing and retaining water, Mr. Wood presents data from which he concludes that the size of the loaf and the shape of the loaf are determined each by its own separate and distinct factor.

The size of the loaf is determined, according to this author, by 'the amount of sugar contained in the flour together with that formed in the dough by diastatic action.' The argument is that the size of the loaf is regulated by the expansion of the dough and that this expansion is in direct relation to the amount of carbon dioxide produced during fermentation. The carbon dioxide is the direct result of the splitting up of the sugars in the flour by the yeast, hence the amount of sugar originally present plus that formed by diastatic action in the 'rising' of the dough previous to baking, determines the size of the loaf.

As regards the shape of the loaf, Mr. Wood suggests that the physical properties of the gluten constitute the determinative factor. These properties, he points out, are not consequent upon any chemical differences in composition of its nitrogenous constituents, nor are they due to the ratio or total amount of its gliadin, but rather, he suggests, to the presence in varying proportions of certain small quantities of mineral salts—it being well known that the association of such substances may materially affect the physical properties of proteids. In this connection, Mr. Wood concludes: 'In the few cases examined it was found that strength was associated with a high ratio of proteid to salts and weakness with a low ratio. It is suggested that the variation of this ratio may be the explanation of the different physical behaviour of the gluten of strong and weak flours, and that this is the factor which determines that component of strength which governs the shape of the loaf and its powers of retaining gas.' Unfortunately, the quantity of flour at our command in this investigation was not sufficient to allow us to make the necessary determinations, and consequently we have no data to present on this matter.

In all this we are given certain new starting points of considerable interest and much promise, but the case needs considerable elaboration and further confirmatory evidence before it can be accepted as satisfactorily and completely explaining 'strength' as we to-day understand that quality in flour. If 'the capacity of a flour to give off gas when fermented with yeast, especially in the later stages of dough fermentation,' determines largely the size of the loaf, then it seems to the writer that to obtain data from which to judge of a flour in this particular it will be necessary to produce the gas—the volume of which is to be measured—under conditions precisely similar to those obtaining in the bread making process. Therein lies a difficulty of considerable magnitude. The process adopted by Mr. Wood in his gas determinations can scarcely be said to be strictly comparable to that to which dough is subjected in bread-making.

* Journal of Agricultural Science, Vol. II., Part I.

That the shape of the loaf is dependent upon certain physical properties of the gluten seems very probable. Hitherto it has been thought that the proportion in which its two constituents, gliadin and glutenin, existed, had a direct bearing on the consistency, elasticity, &c., of the gluten, but, as already pointed out, the evidence as it accumulates is conflicting—and we must admit that there are so many exceptions without apparent explanation that this theory can only be considered as tentative. The present research throws the greatest doubt upon the 'gliadin number' as a factor of diagnostic value. The same is true respecting the hypothesis that strength is determined by the amount of gliadin present rather than by the ratio of this constituent to glutenin. Mr. Wood offers in this article another explanation for the strength of flour—the ratio of the soluble salts to total nitrogen. It opens up a question well worthy of investigation. At the present time, however, the data are too few to furnish a sufficient basis for diagnostic purposes.

THE CHARACTER OF ANALYTICAL DATA AS COMPARED WITH THAT OF BAKING RESULTS.

In concluding this prefatory statement of the views as at present held respecting the relation of the chemical composition of the flour to the quality known as 'strength,' something must be said as to the nature of the two classes of data which it is sought to correlate. On the one hand we have the analytical results; on the other, the figures or values derived from the baking tests. While it is not claimed that the former are absolute (for there is always a slight error of experiment, no matter how skilful the chemist) they can for all practical purposes be looked upon as representing facts. Thus, the percentage of nitrogen or of ash found in a flour will not appreciably vary with the analyst; the personal factor is practically eliminated. But such cannot be said to be equally true in baking trials, personal opinion being largely used, as in judging shape, texture, &c. And, again, the values from the baking operations must necessarily be influenced by variations in manipulation and temperature, in the vitality of the yeast, and by a number of other factors. These factors the baker cannot, no matter how careful and skilful he is, keep constant from day to day, or even from hour to hour—and the same consideration shows how improbable it is that any two baking experts will assign the same value to a flour. This is not said with any intention of disparaging the baking values—they are possibly more reliable as a guide in valuing flours than the chemical data—but to make it clear that very serious difficulties present themselves in this matter of harmonizing results.

Much careful work remains to be done before this problem is solved, but undoubtedly the close co-operation of the chemist and the baking expert—practically a new feature in the investigation—will eventually furnish a more satisfactory basis for the valuation of flour than exists to-day.

Discussion of Flours—Series I., 1905-6.

The first series of flours to be discussed comprises twelve samples from wheats milled during the winter of 1905-6, the analysis being made in the early months of 1906. It contains eleven samples of spring wheat, largely cross-bred varieties originated on the Central Experimental Farm, and one of winter wheat, No. 92, Turkey Red. Their milling qualities and baking values, together with certain information respecting their origin, are to be found in Part I. of this bulletin among the number examined by the Cerealist, December, 1905-March, 1906.

The analytical determinations made were: moisture, albuminoids or protein, gliadin, wet and dry gluten, directly reducing sugars and sugars after inversion, *i.e.*, non-reducing sugars:—

Analysis of Flours—Series I., 1905-1906.

No.	Variety of Wheat, Locality and Year of Growth.	Moisture.	Protein or Albuminoids. N x 5·7	Gliadin.	Percentage of Albuminoids in the form of Gliadin.	Sugars. Directly reducing calculated as Maltose.	Sugars. Non-reducing calculated as Cane Sugar.	Sugars. Total.
81	Aurora, C.E.F., 1905	7·77	10·60	4·56	43·02	·10	·74	·84
83	Red Fife H., C.E.F., 1905	7·81	13·33	6·49	48 68	Trace.	·87	·87
85	Soft Red Fife, Man., 1905	7·80	9·17	3·93	42·85	·18	1·02	1·20
86	Hard Red Fife, Man., 1905	7·79	11·79	5·64	47·82	.....	.....	.....
87	Assiniboia, Man., 1905	7·80	9·40	4·21	44·78	·03	·98	1·01
88	Huron (selected) C.E.F., 1905	7·61	13·22	6·61	50·00	·09	·84	·93
90	Gatineau, C.E.F., 1905	7·70	15·50	8·03	51·80	Trace.	·78	·78
91	9 J 3, C.E.F., 1905	7·89	14·39	7·18	49·89	.....	.....	.....
92	Turkey Red from Kansas	7·47	16·13	7·29	45·18	·09	·76	·85
95	Advance, C.E.F., 1905	7·68	14·42	6·72	46·60	Trace.	·84	·84
98	Laurel, C.E.F., 1905	7·75	11·51	6·04	52·47	.....	.....	.....
99	Colorado No. 30 from Colorado	7·61	13·96	6·38	45·70	Trace.	1·14	1·14

No.	Variety of Wheat, Locality and Year of Growth.	Gluten. Wet.	Gluten. Dry.	Gluten. Ratio of dry to wet.	Gluten. Physical Characters.	Baking value. Cerealist's Figures.
81	Aurora, C.E.F., 1905	36·79	12·01	3·06	Good quality; resilient	91
83	Red Fife H., C.E.F., 1905	43·07	14·09	3·06	" "	99
85	Soft Red Fife, Man., 1905	28·67	10·62	2·70	" "	89
86	Hard Red Fife, Man., 1905	41·45	14·89	2·79	" "	100
87	Assiniboia, Man., 1905	32·26	10·97	2·94	Yellowish; lacking somewhat in cohesiveness	91
88	Huron (selected) C.E.F., 1905	44·14	15·13	2·91	Lacking somewhat in resiliency	87
90	Gatineau, C.E.F., 1905	54·22	17·89	3·03	Good, but slightly sticky	95
91	9 J 3, C.E.F., 1905	58·57	18·70	3·13	Flabby, soft, very sticky, non-resilient	78
92	Turkey Red from Kansas	57·63	18·04	3·19	Good quality; resilient	101
95	Advance, C.E.F., 1905	49·37	17·36	2·84	" "	91
98	Laurel, C.E.F., 1905	42·55	16·17	2 63	" "	76
99	Colorado No. 30 from Colorado.	45·62	18·67	2·44	Good, but rather granular and lacking somewhat in elasticity.	94

Moisture.—The percentage of moisture was obtained by drying the flour in a steam bath, that is, at the temperature of boiling water, for eight hours. The results are somewhat significant. First, as showing a remarkable uniformity in the moisture content of the flours, all ranging between the percentages 7·47 and 7·89; and, secondly, in making plain that all the flours were extremely dry. We have on former occasions remarked on the fact that flours analysed during the winter season, say, from December to March, are characterized by a low moisture-content, due no doubt to the dryness of the atmosphere at that season, and the present results confirm this contention. The moisture-content must affect the absorptive capacity of a flour and its bread-yield, and hence the importance in all investigations to ascertain bread-making values, where comparative results are required, of making the tests at the same period or season of the year and of having moisture determinations made on the flours at the time of the trial as confirmatory that the flours have been alike influenced by atmospheric condi-

tions. In this connection it may be stated that flours produced and analysed in the winter will if exposed, as in bags, till July or August, frequently show an increase of between 4 and 5 per cent in their moisture content.

Protein or Albuminoids.—The percentage of nitrogen as obtained by the Kjeldahl process is multiplied by the factor 5·7 and the result recorded as protein or albuminoids.

Reference to the table of data reveals that considerable differences exist between the members of this series in this important constituent, and hence in their nutritive values. The latter part of this statement is, of course, open to question since the nutritiousness of a bread must be in a sense dependent on its disgestibility, but as this is an unknown factor as regards the present investigation and one which could be to a marked degree modified by the skill of the bread-maker, we must conclude, and the conclusion cannot be far from the truth, that in a series of flours all making palatable bread the percentage of protein marks their relative nutritive value.

Further, it seems more than probable that the percentage of protein is of greater significance than merely indicating nutritive value, a matter upon which, curiously enough, both baker and consumer place little importance. It appears to be a factor of considerable diagnostic value in determining the 'strength' or bread-making qualities. Thus, Mr. A. D. Hall, Director of the Rothamsted Experimental Station, who has been making a special study of quality in wheat for some years past, wrote in 1904*: Although the main question of the cause of 'strength' is still unsolved, it is clear that for the purposes of a selecting test among a number of new varieties, grown side by side, it will be sufficient to determine the total nitrogen. The total nitrogen, as we have seen, fails to measure 'strength' in any absolute sense, but when wheats are grown under the same conditions, the order of their nitrogen content will be the order of their strength, or very nearly so.'

This agrees very well, speaking generally, with the results obtained in these laboratories, in previous investigations. When discussing the correlation of the analytical data with those from the baking tests of the present inquiry this matter will again be referred to, and it will then be seen that in the total nitrogen—or what is the same thing, the protein—(since this is obtained by multiplying the total nitrogen by the constant 5·7) we have a measure of 'strength' of considerable value.

It will not be necessary to enter upon any discriminating discussion of these flours from the standpoint of their protein content, since the object of this work is to ascertain what correlation of the data might exist rather than to classify the wheats. It may however be remarked that in No. 92 we have an excellent example of a winter wheat with a high protein content. This sample of Turkey Red as grown in Kansas, is at least significant in showing that such wheats do exist, in spite of the commonly held view to the contrary.

Gliadin.—The water insoluble protein of wheat flour, more commonly known as gluten, has been shown to consist essentially of two albuminoids or proteids, alike as regards their nitrogen-content, but differing in their physical characteristics. They have been named gliadin and glutenin. Gliadin is a glue-like, sticky body and serves to bind and hold together the non-adhesive, non-plastic glutenin (as well as the starch) when the flour is moistened and kneaded and allows the resultant dough to 'rise' under the fermentative action of yeast.

In the prefatory note we spoke of the importance that has been placed by some chemists on the ratio that these constituents bear the one to the other and indicated that our previous work (Bulletin 50, Experimental Farm Series) did not support the position that Snyder had taken, viz., that a good flour should contain from 55 to 65 per cent of its protein in the form of gliadin. The results of the present research again show that such limits cannot be regarded, even approximately, as those within which

* The question of quality in wheat, A. D. Hall, Journal of the Board of Agriculture (Eng.), Vol. XI., No. 6.

good flours must fall. On the whole, our data would seem to be decidedly lower than those recorded by Snyder. It is only exceptional examples that have given us a 'gliadin number' above 50, and the flours yielding 55 have been very rare. These high numbers, it may be pointed out, have by no means been invariably accompanied by high baking values.

The method for the determination of gliadin is based on the fact that this constituent of gluten may be dissolved out by treating the flour with 70 per cent alcohol, which leaves the glutenin unattacked.* We have found that it is important, to obtain strictly comparable results, that the solvent should be prepared with great accuracy. Comparatively slight differences in the strength of the alcohol used, materially affect the percentage of gliadin (?) nitrogen obtained, as the following data obtained in the Farm laboratories, well show:—

*Flour: 'Five Roses,' Lake of the Woods Milling Co.***

Strength of Alcohol by Weight. Per cent.	Gliadin.	Proportion of Protein. in the form of Gliadin.
60	5·36	54·0
62·5	5·30	53·4
65·	5·24	52·9
70·	4·71	47·4
75·	3·41	34·3

Wet and Dry Gluten.—Pure gluten consists, as already remarked, of gliadin and glutenin, and its percentage should correspond more or less closely with that of the albuminoids—the amount of the water soluble proteids in wheat flour being very small. As determined in flour investigations, however, by washing out the starch and subsequent drying in the steam bath, approximations to this datum only are possible. For on the one hand there may be losses through excessive or careless washing or through slight increase in the temperature of the wash water, and on the other hand, there may be gains by retention of fat, fibre and ash constituents, as well as from incomplete drying. According to our method of determination (see page 19, Bulletin 50, Experimental Farm Series), the percentage of dry gluten invariably exceeds, though not in any regular manner or by fixed amounts, the percentage of albuminoids. Estimations made by a process more or less mechanical, as this must be regarded, scarcely admit of that accuracy that characterizes chemical work, and hence are not strictly comparable with analytical data.

The significance of the 'wet' gluten number lies, it is thought, in indicating the relative amount of water taken up in bread-making and, possibly, in that retained on baking. If this be true, we should expect to find a relation between this estimation and the bread yield—a point that will be considered when examining the correlation of the data from the baking trials with those from the analytical work.

The character or quality of the wet gluten is an important factor. In flours of high bread-making values, it is resilient, elastic, firm and cohesive; in poor flours it may be flabby, non-resilient, soft and sticky.

Sugars.—The publication of Mr. Wood's work, already referred to, led us to make determinations of the sugars, reducing and non-reducing, present in these flours, though unfortunately from lack of material in several of the samples, the data from the series

* Ti five grammes of flour in an Erlenmeyer flask 250 cubic centimetres of 70 per cent (by weight) alcohol are added and the whole agitated at intervals for several hours. After 24 hours the solution of gliadin is separated by filtration and an aliquot portion acidified with sulphuric acid and its alcohol evaporated. The gliadin nitrogen is then determined by the Kjeldahl process.

** This well known brand is largely if not entirely made from North-western wheat and ranks with the best Canadian flours for bread making.

are incomplete in this respect. It will be remembered that the amount of the sugars, either present as such or produced by diastatic action in the process of bread-making, was considered by Mr. Wood as a factor in determining the size of the loaf.

Our process was, briefly, as follows:—

To 20 grammes of the flour placed in an Erlenmeyer flask 200 cubic centimetres of a 70 per cent (by weight) solution of alcohol are added and the whole well shaken every five minutes for one hour. The mixture is then allowed to stand for 12 hours, at the end of which period the supernatant liquid is thrown on a dry filter and the sugars determined in accurately measured aliquot portions of the filtrate by means of Fehling's solution, gravimetrically.

We have on record very little definite knowledge as to the amount and nature of the sugar or sugars that are present in flours, and it would not seem profitable, here, to enter upon any discussion of the various views presented on this subject of sugar content. Such a discussion would not throw any light upon the problem under consideration, viz., the relation (if any exists) betwen the sugars in sound flours and the size of the loaf produced therefrom. There seems, however, but little doubt of two conclusions: that the amount of such sugars is never large (usually less than 1 per cent) and that of this the proportion in the form of sugars that would very readily break up with gas production, is extremely small—in many instances not more than traces.

Our method of analysis (*) did not permit of the estimation of sugars formed by diastatic action in the dough and therefore the results presented are not strictly comparable with those of Mr. Wood, who measured the carbonic acid evolved while the dough was in fermentation. They are not brought forward to confirm or refute his conclusions. They are valuable, however, in showing the amounts of the sugars present and as such, the writer thinks, should give some evidence of the relative loaf-size, if the hypothesis be a sound one. The following are the data, the order being that of the volume, and it is obvious that they do not indicate any relation between sugar-content and size of loaf**:—

Flour.	Volume of Loaf.	Sugars Per cent.
No. 86	560	....
" 92	550	·85
" 83	538	·87
" 95	526	·84
" 81	516	·84
" 90	514	·78
" 85	504	1·20
" 87	504	1·01
" 88	490	·93
" 99	473	1·14
" 91	454	....
" 98	428	....

It is to be admitted that the quantity of flour used in this estimation was small and the number of analyses was not large, nevertheless there seems no reason to doubt the accuracy of the data. The determinations were made with the utmost care and always in duplicate, closely concordant results being obtained.

The writer does not wish to be thought as bringing forward any data that might be considered as contradicting the view that the volume of gas produced in the fer-

* That the solvent used would dissolve out all the sugars present in the flours is, I think shown by the following experiment: One gramme of maltose, grape sugar and cane sugar each was placed in an Erlenmeyer flask in contact with 100 cubic centimetres of 70 per cent alcohol and left standing over night. At the end of that time examination showed that the sugars were entirely dissolved.

** Sufficient flour was not obtainable in samples Nos. 86, 91 and 98 for the determination of the sugars.

mentation is a measure of the size of the resultant loaf—we can offer no data on that point, but it does seem more than probable that the very small amount of sugar in sound flours cannot be regarded as having any marked influence in that direction. If Mr. Wood's contention is correct it seems to the writer that it is the relative activity of the diastatic action set up by the yeast, on possibly many compounds of the flour, that is the determinative factor, and not chiefly the amount of sugars existant in the flours.

CORRELATION OF THE DATA.

The most interesting features of the work will be brought out by considering first, how far the chemical data may agree among themselves and secondly what relationship may exist between these data and the values obtained in the baking tests.

Arranging the flours in the order of their protein content and comparing the results with the data for the gliadin and dry gluten, similarly arranged from the highest percentage downwards, it will be found (1) that four of the first five flours in each column are the same; (2) that as regards protein and dry gluten the first five flours are the same in both columns; (3) that not only are the last three flours in each of the three columns the same, but that the order is the same in all.

This general agreement between these three classes of data will be apparent by an examination of the following table, in which these determinations have been placed side by side in the arrangement described:—

RELATIONSHIP OF PROTEIN TO GLIADIN AND DRY GLUTEN.

Protein.	%	Gliadin.	%	Dry Gluten.	%
No. 92	16·13	No. 90	8·03	No. 91	18·70
" 90	15·50	" 92	7·29	" 99	18·67
" 95	14·42	" 91	7·18	" 92	18·05
" 91	14·39	" 95	6·72	" 90	17·89
" 99	13·96	" 88	6·61	" 95	17·36
" 83	13·33	" 83	6·49	" 98	16·17
" 88	13·22	" 99	6·38	" 88	15·13
" 86	11·79	" 98	6·04	" 86	14·89
" 98	11·51	" 86	5·64	" 83	14·09
" 81	10·60	" 81	4·56	" 81	12·01
" 87	9·40	" 87	4·21	" 87	10·97
" 85	9·17	" 85	3·93	" 85	10·62

There seems to be little doubt, therefore, but that there is a relationship, more or less close, between these determinations, that the percentage of gliadin and of dry gluten will increase and decrease with that of the protein, though apparently not regularly and without any constant difference.

The 'gliadin number' (proportion of protein in the form of gliadin) is very erratic, compared with the percentage of protein. It is true that certain of the flours with the highest protein also have a high 'gliadin number' and that the last three flours in the above list have, similarly, the lowest 'gliadin number,' but evidence is lacking of any agreement between these determinations in the larger number of instances. We may, therefore, conclude from the data under discussion that no definite ratio has been discovered between these estimations.

The wet gluten follows the dry gluten, though not regularly. As a rule the more of the latter the higher will be the former, but the ratio is not constant. Undoubtedly the property of holding moisture is one possessed in varying degrees by different glutens, but the reason for this we have yet to find.

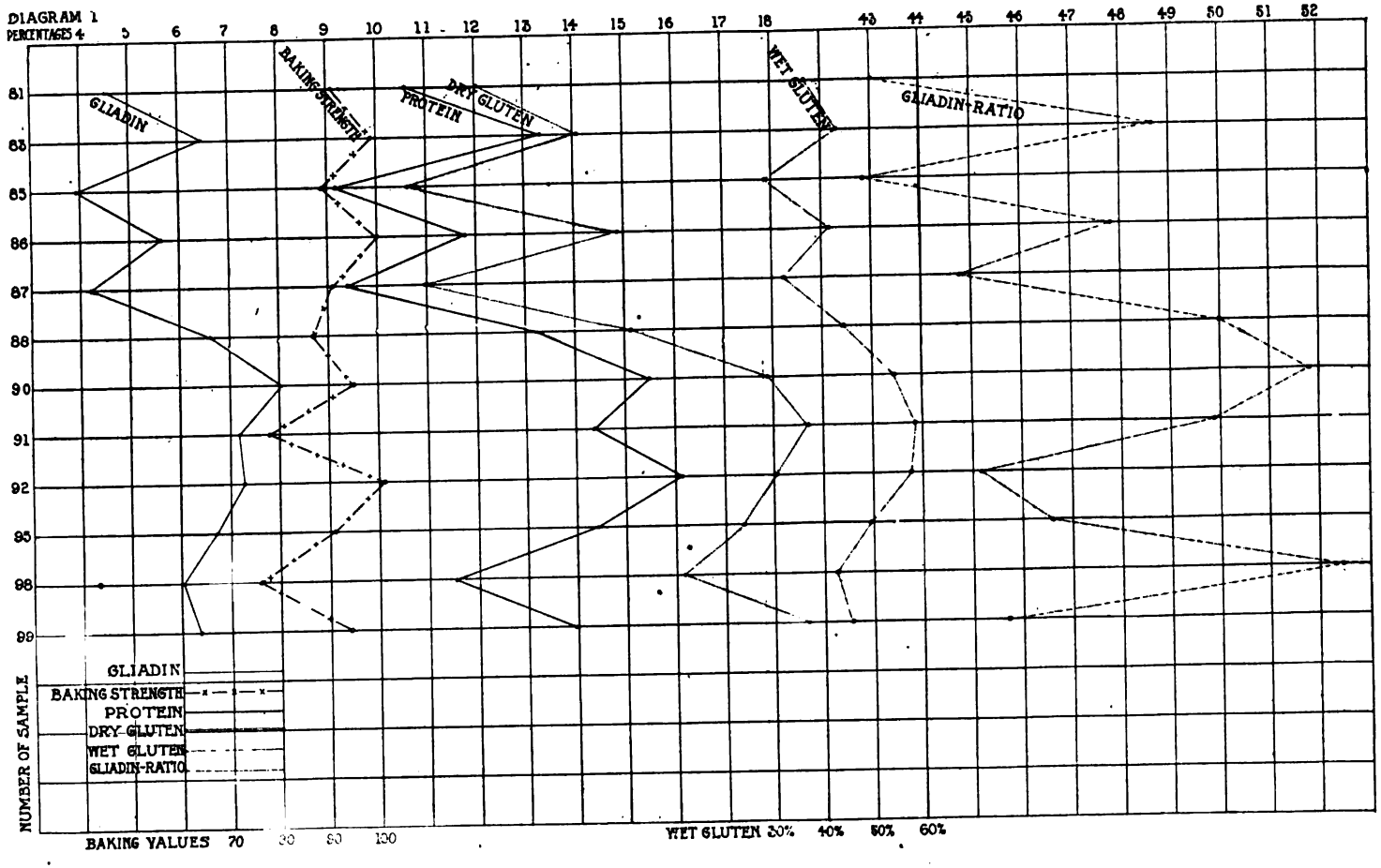


DIAGRAM 1
PERCENTAGES 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 43 44 45 46 47 48 49 50 51 52
GLIADIN
BAKING STRENGTH
PROTEIN
DRY GLUTEN
WET GLUTEN
GLIADIN-RATIO
81 83 85 86 87 88 90 91 92 95 98 99
NUMBER OF SAMPLE
GLIADIN
BAKING STRENGTH
PROTEIN
DRY GLUTEN
WET GLUTEN
GLIADIN-RATIO
BAKING VALUES 70 80 90 100
WET GLUTEN 30% 40% 50% 60%

Comparison of the data for the wet and dry gluten with those for volume and bread yield (see Part I.) makes it apparent that there is no constant ratio between any of these determinations. It is further evident from the results presented that the bread yield does not necessarily increase with an increase of wet or dry gluten.

In order to show at a glance the relationship that may exist between these determinations and their relationship to 'Baking Strength,' Diagram I. has been prepared. Upon it has been plotted the various estimations and the 'gladin number,' the figures for the 'Baking Strength,' taken from Part I. being also given. The points indicating the percentages have been joined to assist the eye in making the correlation.

In the first place, the general agreement between the protein, gliadin, wet and dry gluten will be observed. The plottings may with advantage be discussed and the exceptions noted as follows:—

The curves showing the percentages of protein and gliadin give evidence of a fair measure of parallelism; if the percentage of gliadin in No. 92 had been higher it would have allowed the whole series to present a more pronounced agreement, but nevertheless the trend is the same throughout.

Comparing the protein with the wet and dry gluten, it will be seen that, with the exception of the data from one sample, all three curves follow one another closely, though, as already remarked, there is not a constant ratio between these data. The exception is No. 91, and it is significant that it was this flour only of the whole series that gave a decidedly flabby, soft, sticky, non-resilient gluten. This relationship or rather agreement between the protein and gluten has also been noticed by Thatcher, who in a recent article on the 'Baking Qualities of Flour.'* says, 'another interesting fact is that the precentage of protein, as determined by a chemical process, and that of gluten, as separated mechanically, is in very close agreement, except in the case of those samples where the total nitrogenous matter is low.'

Perhaps of still greater interest will it be to make such correlation as exists between the baking strength as determined by the Cerealist, and the chemical data.

At first sight, a general agreement between the 'Baking Strength' and the percentages of the nitrogenous compounds is to be noticed. However, on closer inspection it will be plain that while the trend of these curves throughout the series remains the same (with one exception), the parallelism is far from perfect for the series. The first five flours, Nos. 81, 83, 85, 86 and 87, have furnished data both as to Baking Strength and percentages of protein, gliadin and wet and dry gluten that show a distinct though not absolute correlation, and omitting the figures for the gluten determinations of No. 91, the last six flours on the chart also show a more or less close parallelism.

Discussion of Flours.—Series II., 1906-7.

This series comprises thirty flours from wheats milled in December, 1906. Of these wheats, twenty-five were spring varieties, three winter (Nos. 102, 103, 151), and two Durum. The results of the milling and baking tests of this series are given in the second group of tables in Part I.

The analytical work was begun about the middle of January, 1907, and completed towards the end of April following. In addition to the determinations made on the first series (see page 39) the precentages of total ash and ash in gluten were obtained.

* Journal Am. Chem. Soc., vol. xxix., No. 6, pp. 910-921.

Analysis of Flours—Series II., 1903-1907.

Number.	Variety of Wheat, Locality and Year of Growth.	Weight of 100 Kernels.	Moisture.	Ash.	Protein or Albuminoids (N x 5·7)	Gliadin.	Percentage of Albuminoids in the form of Gliadin.	Baking value. (See Part I.)
102	Dawson's Golden Chaff, C.E.F., 1906	3·951	8·40	·45	7·75	3·82	49·2	76
103	Turkey Red, No. 380, " "	3·951	8·27	·55	9·75	4·45	45·6	98
106	Stanley, A " "	3·249	8·34	·60	8·89	3·99	44·9	87
107	Stanley, C " "	2·777	8·26	·70	12·23	6·16	50·4	89
108	Ladoga, " "	2·474	7·75	·70	11·69	5·47	46·8	75
109	Red Fife H " "	2·461	7·39	·62	13·45	6·33	47·1	102
112	Ebert " "	3·064	7·75	·71	11·86	5·02	42·3	65
113	Spence Yellow " "	2·889	7·93	·71	13·85	6·33	45·7	·76
114	Gatineau " "	3·182	8·68	·80	13·68	7·07	51·7	96
117	White Russian " "	3·125	7·42	·60	11·97	5·64	47·1	82
118	Preston A " "	3·054	8·01	·74	9·41	3·76	38·3	84
120	Percy A, " "	2·667	7·20	·79	10·66	4·05	38·0	83
122	Kubanka " "	3·487	7·35	1·06	13·51	5·59	41·3	99
123	Goose " "	3·331	8·07	1·25	14·71	6·84	46·5	81
125	Colorado " "	3·519	7·35	·59	11·17	5·07	45·4	77
126	Pringle's Champlain " "	2·804	8·43	·64	11·74	5·59	47·6	93
131	Huron (selected) " "	2·701	8·02	·67	11·00	5·42	49·3	82
132	Red Preston " "	2·778	7·35	·73	11·91	4·73	39·7	83
134	Herisson Bearded " "	2·530	7·34	·53	10·03	4·90	48·8	84
135	Hayne's Blue Stém " "	2·932	7·80	·67	12·31	5·64	45·8	100
136	Red Fern " "	2·559	7·88	·68	12·14	5·36	44·1	96
138	Bobs " "	3·087	7·23	·63	11·23	5·30	47·2	98
139	Chelsea " "	2·772	7·05	·75	11·69	5·42	46·3	99
141	Grant " "	2·881	7·45	·74	12·31	5·81	47·2	57
145	Laurel " "	2·892	8·05	·56	11·46	5·47	47·7	76
146	Red Fife Indian Head, 1906	2·673	8·34	·52	15·85	7·41	46·7	95
147	Pringle's Champlain " "	2·787	8·33	·47	13·34	5·02	37·6	80
149	Red Fife C.E.F., 1902	3·133	8·21	·67	11·06	5·30	47·9	107
150	White Fife C " 1906	2·879	8·16	·66	14·08	6·84	48·6	100
151	Turkey Red, Lethbridge, Alta., 1906	3·269	7·85	·52	12·43	5·87	47·2	87

Analysis of Flours—Series II., 1906-1907.

Number.	Variety of Wheat, Locality and Year of Growth.	Sugars.			Gluten.						
		Directly-reducing calculated as Maltose.	Non-reducing calculated as Cane Sugar.	Total.	Wet.	Dry.	Ratio of Dry to Wet.	Ash.	Physical Characters.		
									Resiliency.	*Elasticity.*	*Colour.*
102	Dawson's Golden Chaff, C.E.F., 1906	·11	·96	1·07	26·61	9·55	2·78	·074	Poor.	Poor.	Slightly yellow.
103	Turkey Red, No. 380 " ..	·14	·82	·96	34·22	11·15	3·07	·097	Good.	Good.	Good.
106	Stanley A " ..	·15	·88	1·03	27·50	9·52	2·89	·077	Fair.	"	"
107	Stanley C " ..	·13	·87	1·00	44·42	14·86	2·99	·179	Poor.	Fair.	Slightly yellow.
108	Ladoga " ..	·09	·98	1·07	41·37	13·26	3·12	·151	Fair.	Good.	Slightly yellow and sticky.
109	Red Fife H " ..	Trace.	·83	·83	45·70	16·07	2·84	·102	Good.	Good.	Good.
112	Ebert " ..	Trace.	·96	·96	38·45	13.57	2·83	·100	Fair.	Poor.	Fair.
113	Spence Yellow " ..	·11	1·11	1·22	46·18	16·51	2·80	·127	Good.	Good.	Good.
114	Gatineau " ..	.....	.....	.....	47·10	16·28	2·89	·121	"	"	"
117	White Russian " ..	Trace.	·75	·75	39·33	13·81	2·85	·055	"	"	"
118	Preston A " ..	·02	1·10	1·12	30·75	10·76	2·86	·111	Fair.	"	"
120	Percy A " ..	·05	1·17	1·22	34·45	12·54	2·74	·126	"	"	"
122	Kubanka " ..	·12	1·28	1·40	46·70	16·54	2·82	·292	Good.	"	"
123	Goose " ..	·14	1·60	1·74	45·47	15·86	2·86	·323	"	"	"
125	Colorado " .	·11	·68	·79	36·50	12·31	2·96	·076	Poor.	Poor.	"
126	Pringle's Champlain " ..	·16	·46	·62	37·85	13·56	2·79	·114	Good.	Good.	"
131	Huron (selected) " ..	·11	·82	·93	37·18	13·03	2·85	·123	"	Fair.	"
132	Red Preston " ..	·05	1·05	1·10	38·35	13·37	2·86	·135	"	"	"
134	Herisson Bearded " ..	Trace.	·64	·64	35·11	12·35	2·84	·097	Poor.	Poor.	"
135	Haynes Blue Stein " ..	Trace.	·79	·79	40·99	14·06	2·91	·096	Good.	Good.	"
136	Red Fern " ..	Trace.	·69	·69	42·58	13·71	3·10	·131	"	"	"
138	Bobs " ..	·08	·83	·91	40·06	13·58	2·95	·093	"	"	"
139	Chelsea " ..	·08	1·05	1·13	37·44	13·63	2·74	·135	"	"	"
141	Grant " ..	.....	.....	.....	39·44	14·67	2·66	·113	"	"	"
145	Laurel " ..	·02	·95	·97	42·40	16·90	2·50	·100	Fair.	Fair.	"
146	Red Fife, Indian Head, 1906	Trace.	·96	·96	55·82	19·61	2·85	·110	Good.	Good.	"
147	Pringle's Champlain, Indian Head, 1906	Trace.	·62	·62	47·72	17·23	2·76	·091	"	"	"
149	Red Fife, C.E.F., 1902..... ..	·06	·92	·98	37·33	13·93	2·68	·101	"	"	"
150	White Fife C, C.E.F., 1906.....	Trace.	·68	·68	49·30	16·81	2·93	·123	"	"	"
151	Turkey Red, Lethbridge, Alta., 1906..	·09	1·00	1·09	46·15	15·00	3·07	·120	"	"	"

Moisture.—These flours do not present quite the same uniformity nor are they quite so low as regards moisture content as those of Series I, most probably due to slight and more or less irregular absorption of moisture from the atmosphere, the determination being made in April, when the air is not so constantly or consistently dry as in mid-winter.

Protein or Albuminoids.—The percentages of protein range from 7·75 to 15·85, limits which again give evidence of extremely large differences in nutritive value. We have also in these figures a contradiction to the widely accepted view that spring wheats are necessarily rich in protein.

The Durum or Macaroni wheats—Kubanka and Goose (Nos. 122 and 123)—are characterized, as might have been expected, by a high protein content. It is a type invariably rich in gluten, though not yielding a flour, according to the general impression, that is suitable for bread-making.

Samples Nos 103 and 151 are both Turkey Red—the former grown at Ottawa, the latter at Lethbridge, Alta. No. 103 contains 9·75 per cent protein, No. 151, 12·43 per cent protein. It must not be assumed that this difference (2·68 per cent) results entirely from differences in environmental conditions during growth: No. 103 is a selected, pure strain, whereas No. 151 is from a commercial sample and most probably not pure. No. 151 is a further instance (see also No. 92, Series I) of a winter wheat with a high protein content.

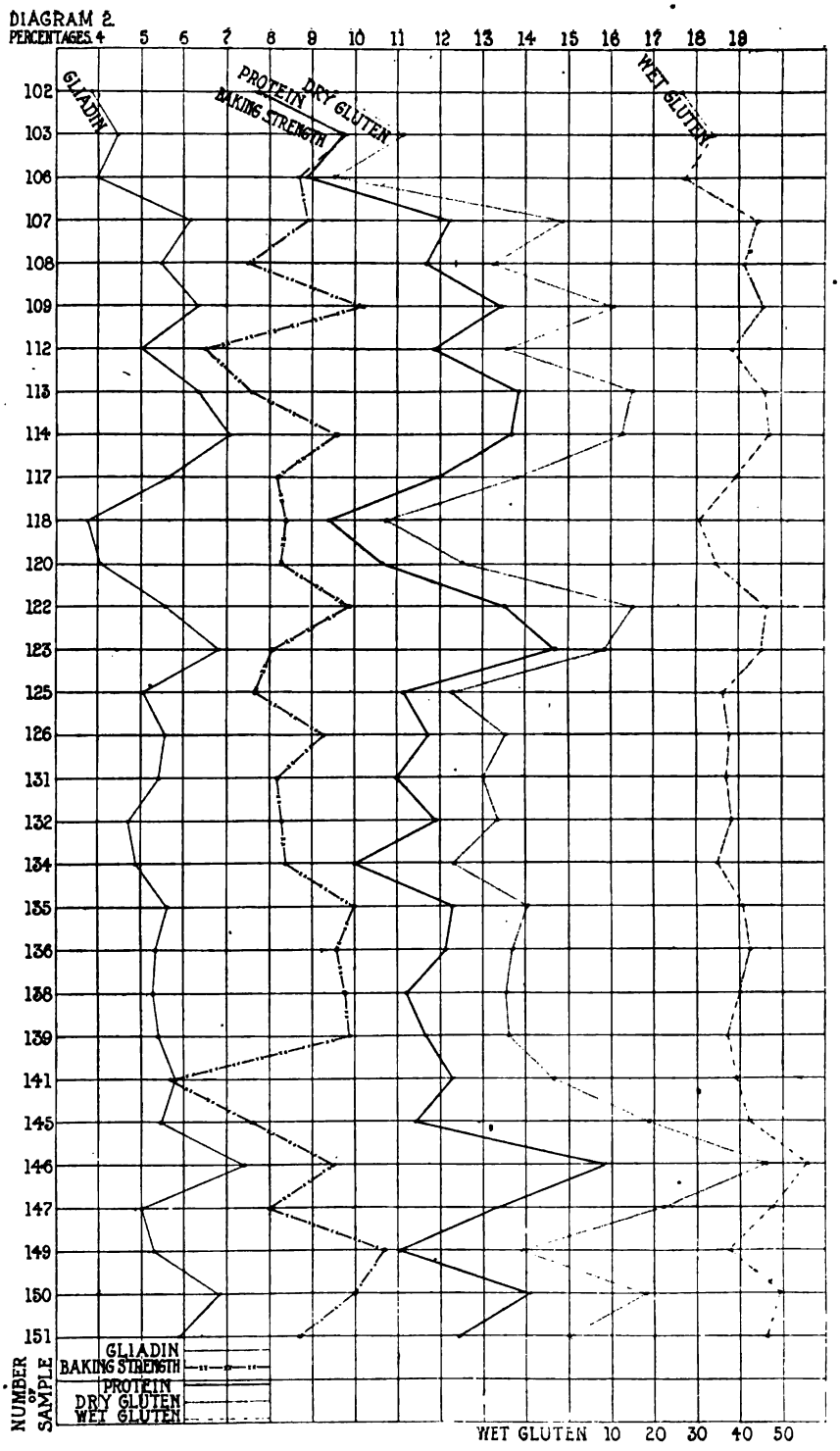
Gliadin-number.—As already pointed out, the 'gliadin-number' of the flours in Series I. was decidedly low: that is, from the standpoint of the limits suggested by Snyder. The same is true of the series under discussion—the highest ratio is 51·7, and in by far the larger number of instances it is below 50·0.

Wet and Dry Gluten.—Since, as we have shown, these data vary, for the most part with the protein, it is not surprising to find in this series very considerable differences. The quality of gluten cannot be measured as accurately as the amount; it must be admitted that as regards physical condition approximations only can be obtained. But granting this, any relation that might exist between quantity and quality should be evident to some degree from these data—and no such correspondence has been found. Undoubtedly the best bread-making flours are, as a rule, those richest in protein, but it is also true that there are flours of excellent quality possessed of but a medium gluten content. Occasionally, also, we find a high gluten content associated with inferior quality. The acceptance of these conclusions makes it clear that the quantity of gluten (or protein) must be regarded as but one factor, though in all probability the one of most importance, in the judging of flours.

The percentage of the ash constituent in the gluten was determined. Excepting the results for the two Durum wheats (Nos. 122,123) this estimation varies from ·055 per cent to ·179 per cent. For the most part these figures are much higher than those which would be obtained from the gluten of good commercial flours, a result due undoubtedly to the presence of a larger proportion of the bran elements incidental to the method of milling. Apparently there is no significance to be attached to this—there are no indications of any relation between these results and the other data. It is of interest, however, to note that in the case of the Durum wheats—Kubanka and Goose—this gluten ash is much higher than in any other of the series—possibly due to a larger proportion of bran present in the flour.

Sugars.—Of directly-reducing sugars (e.g., maltose) the amount present is very small—from traces to ·15 per cent; of non-reducing sugars (e.g., cane sugar) the percentage is larger, but still seldom exceeds 1 per cent. The Durum varieties, Kubanka and Goose, contain slightly more than any of the others of the series, with 1·28 per cent and 1·60 per cent cane sugar respectively. If these two wheats are excepted, the total sugars present fall within the limits, ·62 per cent and 1·22 per cent.

DIAGRAM 2.


PERCENTAGES 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
GLIADIN
PROTEIN
DRY GLUTEN
BAKING STRENGTH
WET GLUTEN
102
103
106
107
108
109
112
113
114
117
118
120
122
123
125
126
131
132
134
135
136
138
139
141
145
146
147
149
150
151
NUMBER OF SAMPLE
GLIADIN
BAKING STRENGTH
PROTEIN
DRY GLUTEN
WET GLUTEN
WET GLUTEN 10 20 30 40 50

On Diagram II. plottings are given of the following values: 'Baking Strength,' Protein, Gliadin and Wet and Dry Gluten. Omitting for the moment consideration of the 'Baking Strength,' the general agreement already referred to between the other data will be at once apparent. Thus between the protein and the gliadin it is only in four instances out of thirty that the trend is not in the same direction. A very fair agreement is also observed between the protein and the wet and dry gluten determinations: the trend is divergent in two cases only in comparing protein and wet gluten.

In Series I. the trend of the curves denoting 'Baking Strength' was with one exception in the same direction as that of the protein (see Diagram I). This agreement is not so marked in Series II.; in ten instances (one-third of the number of samples examined) there is no possible correlation. No explanation or reason for this can at the moment be offered; the data have been carefully studied but they reveal nothing that throws any light upon these (apparently) exceptional cases. It is, of course, open to question if there exists a distinct relation between protein and 'Baking Strength,' though it must be admitted the balance of proof certainly goes far to support that contention. On the other hand, it might be urged that still further modifications in the baking process might alter the present values assigned to baking strength and bring them into greater consonance with the protein content.

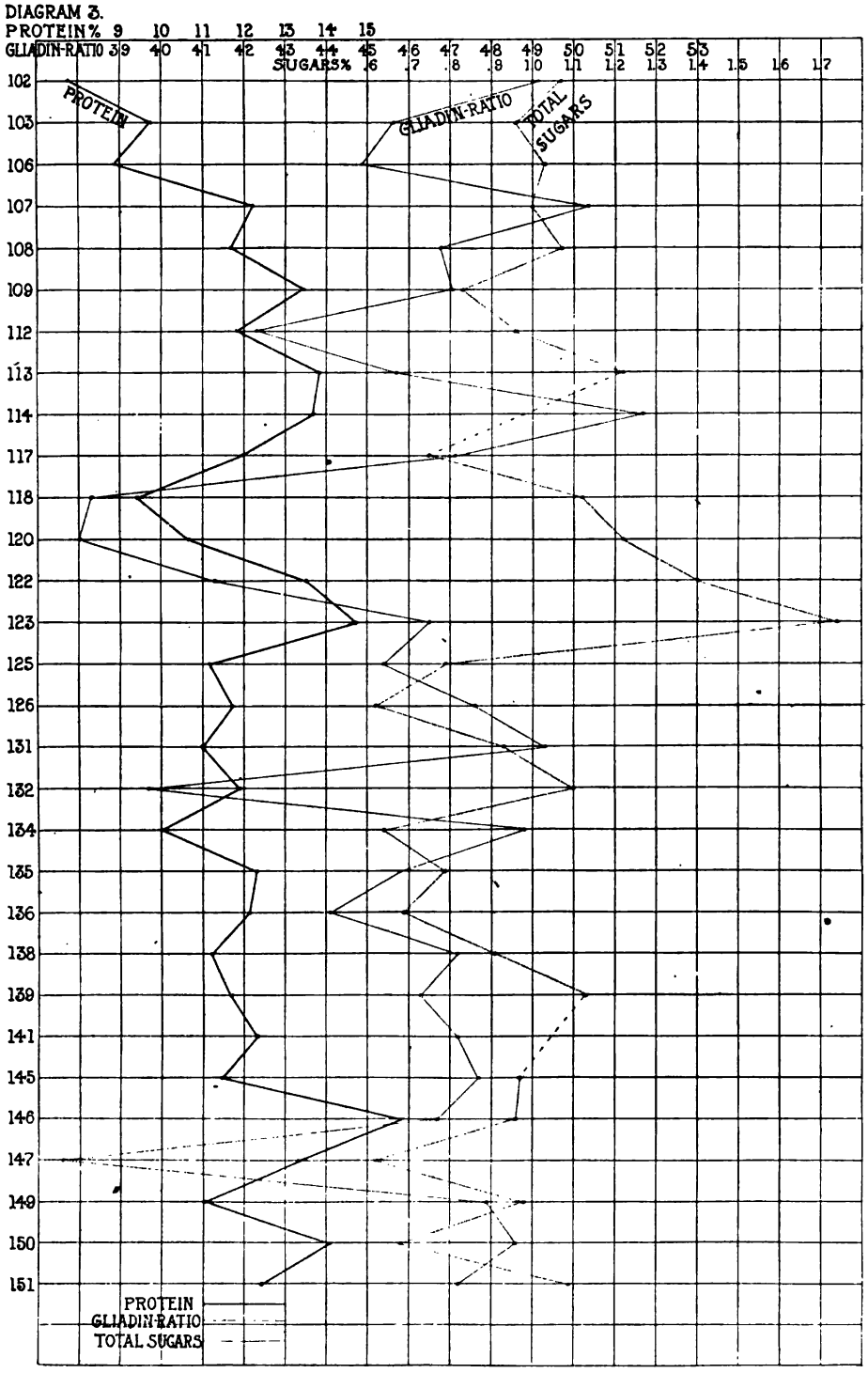
It has already been pointed out that between the protein and gliadin of this series a very fair measure of parallelism exists; it follows, therefore, from what has just been said that there is no better correlation to be discovered between the 'Baking Strength' and gliadin than that between 'Baking Strength' and protein.

Diagram III. bears the plottings of the Protein, 'Gliadin-number' and Total Sugars. Again, no relation is to be found between the 'gliadin number' and protein content, nor is there any apparent relation between the 'gliadin-number' and the Baking Strength, if the curves of the former be compared with those of the latter as given on Diagram II.

The sugar results are extremely erratic, as in Series I., and do not show any agreement, save in a few exceptional instances, with any of the other data. They appear to be quite independent, not only of the nitrogenous compounds in the flour—which perhaps is not to be wondered at—but also of the various factors that go to make up baking strength.

Before summing up the results given in this part of the bulletin and drawing such conclusions as may be possible, it will be well to point out that there has been no attempt on the part of the writer to classify the flours examined from the chemical data. The intention, as stated at the outset, was merely to ascertain what relationship might exist between composition as revealed by analysis and the Baking Strength as determined by the practical trials of the Cerealist. Incidentally, we have obtained confirmatory evidence of the relation between certain of the nitrogen compounds, as well as information on one or two other points of interest in connection with this question of quality in wheat.

DIAGRAM 3.


PROTEIN%
GLIADIN-RATIO
SUGARS%
PROTEIN
GLIADIN-RATIO
TOTAL SUGARS
PROTEIN
GLIADIN-RATIO
TOTAL SUGARS

Summary.

In bringing to a close this brief discussion af the data, it seems to the writer that we may safely conclude that the evidence presented shows:—

1. That between the protein, gliadin and wet and dry gluten there is a distinct relationship, but that there is no evidence of a definite or absolute ratio. It is apparently approximate in character. The only instance in Series I. in which an agreement did not obtain, that is, in which the same trend was not apparent between these data, was in the case of a flour possessing a gluten of markedly inferior quality. In Series II., though the agreement is not so close as in Series I., there is nevertheless good evidence of a close relationship between these determinations.

2. That the 'gliadin number,' though holding with the other nitrogenous data in certain parts of the series, is evidently a datum not to be considered as definitely related to the nitrogen compounds or to the 'Baking Strength.'

3. That while it may not be possible to prognosticate from the nitrogen determinations (protein, gliadin, and gluten) the particular order in which the members of any series of flours will fall when submitted to a baking test, these estimations constitute factors of prime importance in judging of the value of a flour for bread-making purposes, and especially is this true when taken into consideration with the physical character of the gluten. The results from both series of flours clearly indicate a distinct relationship between these chemical data and 'Baking Strength'—a figure made up chiefly of the values for volume, shape and weight of loaf. It does not appear, however, that any definite ratio can be established between these two classes of data.

4. That if the size of the loaf produced is controlled by the volume of gas evolved in the bread-making process, then this volume is dependent on the degree of the enzymic action (which may affect the proteids as well as the carbo-hydrates) rather than on the amount of sugar present in the flours.

5. That no relationship has been discovered between the ratio of total ash to protein and 'Baking Strength,' nor between the ratio of ash in gluten to protein and 'Baking Strength.'

For assistance in the analytical work and in the preparation of the data, the writer would gratefully acknowledge his indebtedness to Mr. A. T. Charron, Mr. H. W. Charlton and Mr. A. G. Spencer, of the Chemical staff.

133
E22

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

RESULTS OBTAINED IN 1907

ON THE

DOMINION EXPERIMENTAL FARMS

FROM TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS AND POTATOES

BY

WILLIAM SAUNDERS, C.M.G., LL.D.
Director of Experimental Farms

AND

CHAS. E. SAUNDERS, Ph. D.
Cerealist

BULLETIN No. 58

DECEMBER, 1907

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER,
MINISTER OF AGRICULTURE

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

RESULTS OBTAINED IN 1907

ON THE

DOMINION EXPERIMENTAL FARMS

FROM TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS AND POTATOES

WILLIAM SAUNDERS, C.M.G., LL.D.
Director of Experimental Farms

AND

CHAS. E. SAUNDERS, Ph. D.
Cerealist

BULLETIN No. 58

DECEMBER, 1907

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER,
MINISTER OF AGRICULTURE

To the Honourable

The Minister of Agriculture.

SIR,—I beg to submit herewith, for your approval Bulletin No. 58 of the Experimental Farm series, which has been prepared by the Cerealist, Dr. C. E. Saunders and myself. There are presented in this publication the results of a large number of experiments, which have been conducted at all the experimental farms in your Department during the season of 1907, with spring wheat, durum or macaroni wheat, emmer and spelt, oats, barley, peas, Indian corn, turnips, mangels, carrots, sugar beets and potatoes. The average results are also given of the tests for the past five years of those varieties which have been long under trial.

These test plots are conducted with the object of gaining information as to the relative productiveness of the different sorts and their earliness in ripening. The returns show much variation in the weight of the crops grown and point to the importance of care in the choice of varieties of seed for sowing. It is hoped that these results giving the experience gained under some of the more important climatic variations found in the country, will prove useful to farmers in every part of Canada.

I have the honour to be sir,

Your obedient servant.

WM. SAUNDERS,

Director of Experimental Farms.

OTTAWA, December 4th, 1907.

TABLE OF CONTENTS

PAGE.

Results at Central Experimental Farm Ottawa, Ont 6-12

Spring Wheat, 6, Durum Wheat, 7, Emmer and Spelt, 7, Oats, 8, Barley, 8-9, Peas, 9, Indian Corn, 9-10, Turnips, 10, Mangels, 11, Carrots, 11, Sugar Beets, 11, Potatoes, 12.

" **at Experimental Farm Nappan, N. S** 12-18

Spring Wheat, 12-13, Durum Wheat, 13, Emmer and Spelt, 13, Oats, 14, Barley, 14-15, Pease, 15, Indian Corn, 15-16, Turnips, 16, Mangels, 16-17, Carrots, 17, Sugar Beets, 17, Potatoes, 18.

" **at Experimental Farm Brandon, Man** 18-24

Spring Wheat, 19, Durum Wheat, 19, Emmer and Spelt, 20, Oats, 20, Barley, 20-21, Peas, 22, Indian Corn, 22, Turnips, 23, Mangels, 23, Carrots, 23, Sugar Beets 24, Potatoes, 24.

" **at Experimental Farm Indian Head, Sask** 24-31

Spring Wheat, 25, Durum Wheat, 26, Emmer and Spelt, 26, Oats, 26-27, Barley, 27-28, Peas, 28, Indian Corn, 28-29 Turnips, 29, Mangels, 29-30, Carrots, 30, Sugar Beets, 30, Potatoes, 31.

" **at Experimental Farm Agassiz, B. C** 31-37

Spring Wheat, 32, Durum Wheat, 32, Emmer and Spelt, 32, Oats, 33, Barley, 33-34, Peas, 34, Indian Corn, 34-35, Turnips, 35, Mangels, 36, Carrots, 36, Sugar Beets, 37, Potatoes, 37.

" **at Experimental Farm Lacombe, Alberta** 38-43

Spring Wheat, 38, Durum Wheat, 39, Emmer and Spelt, 39, Oats, 40, Barley, 40-41, Turnips, 41, Mangels, 41, Carrots, 42, Sugar Beets, 42, Potatoes, 42-43.

RESULTS OBTAINED

ON THE

DOMINION EXPERIMENTAL FARMS

FROM TRIAL PLOTS OF

GRAIN, FODDER CORN, FIELD ROOTS AND POTATOES

By William Saunders, C.M.G., LL.D., F.R.S.C., F.L.S., &c.
Director of Experimental Farms

and Chas. E. Saunders, B.A., Ph.D., *Cerealist.*

During the past thirteen years experiments have been conducted on uniform trial plots at each of the older Dominion Experimental Farms for the purpose of gaining information as to the most productive and earliest ripening varieties of grain, fodder corn, field roots and potatoes. In arranging for these plots, the seed has always been supplied at the outset from a common stock. In each case the seed has been sown as early as practicable and, as a rule, all the different varieties of the same crop have been sown on the same day or at most within two or three days, so as to give to all an even start. The land chosen for these plots has been as nearly uniform in character as could be found and before sowing has been brought into a good condition of tilth. In this bulletin, which is the thirteenth of the series, the results of the experiments are presented in a somewhat different form from that of the earlier issues. The establishment of additional experimental farms necessarily disturbs the uniformity of the series of tests, viewed as a whole, and makes it seem desirable to bring together under one heading all the facts relative to each farm rather than to classify the returns under the names of the various crops tested. In this way the peculiarities of the climate and soil of each district will be more clearly displayed and the information presented in a form perhaps more convenient and acceptable to most farmers, who with the increase in the number of experimental farms will in most instances be able to look to one particular farm as fairly representing their own conditions and will naturally feel greater interest in this than in the results obtained in other parts of the Dominion.

The varieties are, as far as possible, arranged in the tables in the order of their average yield for the last five years. Those sorts which have not been grown for five years are arranged in the order of their average yield for the time during which they have been tested. While a five-year period is undoubtedly rather short for reaching any final conclusions, it seems undesirable to lengthen it, since by so doing all recently introduced varieties would be kept too long from taking their place in the tables with the older sorts.

The lists of varieties given do not include all the sorts which are being tested on the experimental farms. Some of the new or less important varieties are omitted here but will be referred to in the annual report of the farms.

In computing the averages for these tables the same five years have been used in each case, except in a few instances where the omission or failure of one of the plots made a blank in the records for that year. These instances are marked with a cross† and the true position in the tables of the varieties so marked is to be regarded as somewhat uncertain.

Cross-bred varieties produced on the experimental farms are marked with an asterisk.*

The yields of most of the crops are expressed in the tables in bushels per acre or tons per acre. The legal bushels in Canada are as follows: wheat 60 lbs., oats 34 lbs., barley 48 lbs., peas 60 lbs., potatoes 60 lbs. The ton contains 2,000 lbs. The yields of emmer and spelt are expressed in pounds per acre.

CENTRAL EXPERIMENTAL FARM, OTTAWA, ONTARIO.

Most of the cereals grown on this farm have given very fair yields during 1907; but some of the early sown sorts have given less than an average crop owing to the unusually wet and late spring. Seeding began about a week later than usual, but was interrupted by unfavourable weather which much delayed the completion of the work. The yield of peas has been above the average. Field roots and Indian corn have given fair returns but potatoes have not done nearly so well as usual.

The plots of grain have been reduced in size at this farm from one fortieth of an acre to one sixtieth. More careful handling is possible with the crop from the smaller plot and it is believed that this reduction in size will cause an increase rather than a decrease in the accuracy of the returns.

The yield per acre of the field roots is calculated from that obtained from one hundredth of an acre, the yield of Indian corn from two rows each 66 feet long, and the yield of potatoes from one row 66 feet long.

SPRING WHEAT.

Fourteen varieties of spring wheat (exclusive of the durum wheats) grown at the Central Experimental Farm during 1907 are here reported on. The wheat was sown April 29th, the seed being used at the rate of about one and one half bushels per acre.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Bishop	31	20	99	38	..	10	Stanley*	26	8	102	25	..
2	Herisson Bearded	30	30	105	42	..	11	White Fife	24	42	108	25	30
3	Pringle's Champlain	30	12	103	38	..	12	Percy*	24	6	102	20	30
4	Colorado	29	56	102	37	..							
5	Preston*	29	14	102	26	30		(For less than 5 years)					
6	Huron*	28	12	105	33	..							
7	White Russian	27	44	109	33	..		Riga* (4 years)	27	25	95	29	..
8	Red Fife	26	38	108	29	30		Hungarian White (3 years)	35	23	103	35	30
9	Red Fern	26	34	105	30	30							

The average crop in 1907 of the fourteen varieties of spring wheat on the Central Experimental Farm was 31 bushels 39 lbs. per acre.

Central Experimental Farm, Ottawa, Ontario.

DURUM OR MACARONI WHEAT.

The results of the test of varieties of durum wheat are published in a separate table, as these wheats possess qualities rather different from those of the ordinary sorts of spring wheat. While it is possible to make good flour from some kinds of durum wheat, such flour is generally unpopular. Furthermore the peculiar character of the kernels necessitates the use of somewhat different methods in the milling of these wheats. They are therefore often looked upon with disfavour by millers.

Farmers who grow any of these varieties should exercise great care to prevent them from becoming mixed with the standard sorts used for flour making.

Four of the varieties of durum wheat grown at Ottawa in 1907 are here reported upon. The seed was sown on May 3rd at the rate of about one and three-quarter bushels to the acre.

Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1907.	Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1907.
	(For five years.)	Bu. Lbs.	Days.	Bu. Lbs.		(For five years.)	Bu. Lbs.	Days.	Bu. Lbs.
1	Roumanian	39 36	108	50 ..	3	Goose	32 54	105	50 30
2	Yellow Gharnovka ...	33 14	109	32 30	4	Mahmoudi	24 46	108	35 30

The average crop in 1907 of the four varieties of durum wheat on the Central Experimental Farm was 42 bushels 8 lbs. per acre.

EMMER AND SPELT.

Two varieties of emmer and two of spelt are here reported upon. The seed was sown on May 10 at the rate of about 120 lbs. to the acre. (This is equal to about four measured bushels.)

Common Emmer is the grain sometimes referred to under the incorrect name of "Speltz".

Number.	Varieties tested.	Average Yield.	Average days maturing.	Yield in 1907.	Number.	Varieties tested.	Average Yield.	Average days maturing.	Yield in 1907.
	(For five years.)	Lbs.	Days.	Lbs.		(For five years.)	Lbs.	Days.	Lbs.
1	Red Emmer.....	2,203	111	1,950	3	Common Emmer.	2,128	104	2,520
2	Red Spelt.....	2,162	113	2,190	4	White Spelt.....	2,050	110	2,430

The average crop in 1907 of the four varieties of emmer and spelt on the Central Experimental Farm was 2,272 lbs. per acre.

Central Experimental Farm, Ottawa, Ontario.

OATS.

Thirty-one of the varieties of oats tested at Ottawa are here mentioned.

The seed was sown on May 2nd and 3rd at the rate of about two bushels per acre, except when the oats were unusually large, in which cases about half a bushel more of seed was used.

Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Twentieth Century...	78	10	100	85	20	18	Danish Island.....	66	22	103	78	18
2	Lincoln.....	74	14	102	69	24	19	Pioneer.....	66	22	101	76	26
3	Banner.....	74	4	102	86	16	20	Golden Fleece†.....	66	15	104	75	30
4	White Giant.....	73	12	102	73	8	21	Golden Giant.....	65	32	107	71	16
5	Wide Awake.....	71	24	102	71	16	22	Sensation.....	65	28	101	76	26
6	Golden Beauty.....	71	16	102	73	8	23	Bavarian†.....	65	6	104	69	24
7	Irish Victor.....	71	8	104	87	12	24	Black Beauty.....	65	..	102	75	..
8	American Triumph...	70	28	102	82	32	25	Goldfinder.....	64	2	104	76	26
9	Abundance.....	70	14	102	85	20	26	Tartar King.....	63	32	99	83	28
10	Swedish Select†.....	70	10	101	85	20	27	Improved Ligowo....	63	4	102	73	8
11	Thousand Dollar.....	69	30	100	79	14	28	Siberian.....	61	32	103	83	28
12	Milford White*.....	69	20	101	78	18	29	Columbus†.....	61	18	101	43	8
13	Improved American..	69	..	103	96	6	30	Joanette.....	59	6	106	65	10
14	Virginia White ...	67	12	102	57	12							
15	Kendal Black*.....	67	6	104	79	14		(For less than 5 years,)					
16	Kendal White*.....	66	30	103	73	8							
17	American Beauty.....	66	28	100	75	30		Storm King (4 yrs.)...	44	19	98	68	28

The average crop in 1907 of the thirty-one varieties of oats on the Central Experimental Farm was 76 bushels, 5 lbs. per acre.

BARLEY.

Fifteen sorts of six-rowed barley and thirteen sorts of two-rowed barley grown at Ottawa in 1907 are here mentioned.

The plots of six-rowed barley were sown on April 26th the seed being used at the rate of about one and three quarter bushels per acre.

The plots of two-rowed barley were sown on April 27th the seed being used at the rate of about two bushels per acre.

SIX-ROWED BARLEY.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Nugent*.....	55	14	95	46	42	9	Empire*.....	47	18	94	45	30
2	Albert*.....	53	18	94	35	30	10	Oderbruch.....	46	28	95	42	24
3	Stella*.....	52	26	93	50	30	11	Claude*.....	45	28	96	35	..
4	Odessa.....	51	38	93	54	18	12	Argyle*.....	44	18	94	25	30
5	Blue Long Head.....	50	34	94	48	6	13	Yale*.....	42	38	95	15	30
6	Mensury.....	50	32	93	33	36	14	Mansfield*.....	38	2	97	33	6
7	Summit*.....	50	32	92	40	..	15	Champion (beardless).	34	4	93	35	..
8	Trooper*.....	49	42	91	31	42							

The average crop in 1907 of the fifteen varieties of six-rowed barley on the Central Experimental Farm was 38 bushels, 12 pounds per acre.

Central Experimental Farm, Ottawa, Ontario.

TWO-ROWED BARLEY.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Standwell	47	42	99	40	30	10	Sidney *	38	18	98	26	42
2	Canadian Thorpe	47	26	99	48	6	11	Logan *	36	24	99	32	24
3	Invincible	47	26	100	46	42	12	Dunham *	36	18	99	34	18
4	French Chevalier	46	40	98	27	24		(For less than 5 years.)					
5	Jarvis *	45	10	96	40	30							
6	Clifford *	44	44	97	47	24							
7	Danish Chevalier	44	38	98	38	6		Swedish Chevalier (4 years)	52	12	96	54	18
8	Beaver *	43	22	95	38	6							
9	Gordon *	40	46	97	25	30							

The average crop in 1907 of the thirteen varieties of two-rowed barley on the Central Experimental Farm was 38 bushels 27 lbs. per acre.

PEAS.

Twenty of the varieties of peas grown at Ottawa are here mentioned. The plots were sown on May 8th. The quantity of seed used per acre varied from two to three bushels, depending on the size of the pea.

Number.	Varieties tested.	Average yield.		Average days maturing	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Picton *	36	12	106	43	..	11	Early Britain	33	22	108	46	30
2	Prussian Blue	36	..	104	47	..	12	Daniel O'Rourke	32	56	105	42	..
3	Victoria *	35	42	110	40	30	13	Agnes *	32	46	106	37	30
4	Golden Vine	35	24	107	34	..	14	Wisconsin Blue	32	46	106	46	30
5	Chancellor	34	58	103	41	30	15	Archer *	32	16	109	38	..
6	Gregory *	34	48	110	40	..	16	Prince Albert	31	50	108	41	30
7	English Grey	34	44	108	43	..	17	Arthur *	31	12	102	43	..
8	Prince *	34	4	108	42	..	18	White Marrowfat	30	52	106	43	..
9	Mackay *	33	42	107	44	..	19	Nelson *	30	26	102	50	30
10	Paragon * †	33	42	104	50	30	20	Black-eye Marrowfat	30	18	107	39	30

The average crop in 1907 of the twenty varieties of peas on the Central Experimental Farm was 42 bushels, 40 lbs. per acre.

INDIAN CORN.

Twenty varieties of Indian corn were tested at Ottawa during 1907. They were sown in rows about three feet apart and the plants thinned out to six or eight inches apart in the rows.

Central Experimental Farm, Ottawa, Ontario.

The seed was sown on June 1st and the crop was cut green for ensilage on September 28th.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons	Lbs.	Tons	Lbs.		(For five years.)	Tons	Lbs.	Tons	Lbs.
1	Eureka	23	552	27	120	13	Clouds Early Yellow	18	608	16	1,000
2	Early Mastodon	22	847	21	900	14	Champion White Pearl	18	25	16	1,110
3	Giant Prolific Ensilage	22	671	23	640	15	White Cap Yellow Dent	17	848	15	360
4	Superior Fodder	22	88	22	1,430	16	King Philip	17	628	16	670
5	Red Cob Ensilage	21	900	21	1,230	17	North Dakota White	16	1,814	14	1,370
6	Early Butler	19	1,798	17	430	18	Angel of Midnight	15	1,218	15	580
7	Salzer's All Gold	19	1,490	21	350						
8	Mammoth Cuban	18	1,994	15	1,020		(For less than 5 years.)				
9	Selected Leaming	18	1,972	19	390						
10	Pride of the North	18	1,554	14	1,480		Wood's Northern Dent (2 yrs.)	18	1,125	21	1,560
11	Compton's Early	18	861	16	1,000		Early Leaming (2 yrs.)	14	875	15	800
12	Longfellow	18	696	16	1,770						

The average crop in 1907 of the twenty varieties of Indian corn on the Central Experimental Farm was 18 tons 911 lbs. per acre.

TURNIPS.

Twelve of the varieties of field turnips tested at Ottawa in 1907 are here reported upon. The seed was sown in drills two feet apart and the young plants thinned out to about seven inches apart in the rows. The seed was sown on May 23rd and the roots were pulled Oct. 22nd.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons	Lbs.	Tons	Lbs.		(For five years.)	Tons	Lbs.	Tons	Lbs.
1	Kangaroo	33	976	32	100	7	Perfection Swede	29	1,992	31	400
2	Jumbo	33	625	33	300	8	Hall's Westbury	29	3	36	1,500
3	Mammoth Clyde	32	1,807	33	400	9	Halewood's Bronze Top	27	1,737	32	1,600
4	Good Luck	31	519	35	1,400	10	Skirvings	27	758	31	800
5	Hartley's Bronze	30	1,359	38	100	11	Carter's Elephant	27	449	30	200
6	Magnum Bonum	30	1,191	33	1,900	12	Bangholm Selected	24	527	28	1,000

The average yield in 1907 of the twelve varieties of turnips on the Central Experimental Farm was 33 tons 142 lbs. per acre.

MANGELS.

Ten sorts of mangels were tested at Ottawa in 1907. The seed was sown in drills two feet apart and the young plants were thinned out to about seven inches apart in the rows. The seed was sown May 23rd and the roots were pulled Oct. 21st.

Central Experimental Farm, Ottawa, Ontario.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons	Lbs.	Tons	Lbs.		(For five years.)	Tons	Lbs.	Tons	Lbs,
1	Prize Mammoth Long Red	36	3	29	200	7	Giant Yellow Globe	28	96	28	1,700
2	Half Sugar White.....	33	1,145	18	300		(For less than 5 years.)				
3	Giant Yellow Intermediate	33	870	30	200		Perfection Mammoth Long Red (1 year)	.....		28	1,600
4	Selected Yellow Globe....	33	468	30	600		Crimson Champion (1 yr.).	.....		27	1,800
5	Yellow Intermediate.....	32	487	25	1,100		Mammoth Red Inter.(1 yr.)	.....		23	200
6	Gate Post	30	280	31	1,100						

The average yield in 1907 of the ten varieties of mangels on the Central Experimental Farm was 27 tons 680 lbs. per acre.

CARROTS.

Six varieties of field carrots were tested at Ottawa in 1907. The seed was sown in drills two feet apart and the young plants were thinned out to about five inches apart in the rows. The seed was sown May 23rd and the roots were pulled Oct. 23rd.

Number.	Varieties tested.	Average Yield.		Yield in 1907.		Number.	Varieties tested.	Average Yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Improved Short White....	27	758	30	900	4	Ontario Champion	26	602	27	1,100
2	Giant White Vosges.... ..	26	1,395	27	1,400	5	White Belgian	20	1,425	21	900
3	Mammoth White Intermediate..	26	1,085	20	900	6	Half Long Chantenay	17	1,865	20	1,900

The average yield in 1907 of the six varieties of carrots on the Central Experimental Farm, was 24 tons, 1,517 lbs. per acre.

SUGAR BEETS.

Three varieties of sugar beets were tested at Ottawa in 1907. The seed was sown in drills two feet apart and the young plants were thinned out to about five inches apart in the rows. The seed was sown May 23rd and the roots were pulled Oct. 23rd.

Number.	Varieties tested.	Average Yield.		Yield in 1907.		Number.	Varieties tested.	Average Yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Wanzleben.....	24	1,509	20	700	3	Vilmorin's Improved	22	1,871	23	1,200
2	French Very Rich	23	1,611	21	–						

The average yield in 1907, of the three varieties of sugar beets on the Central Experimental Farm was 21 tons 1,300 lbs. per acre.

Central Experimental Farm, Ottawa, Ontario.

POTATOES.

Twenty-eight kinds of potatoes grown at Ottawa are here mentioned.

For planting, the potatoes were cut into pieces with at least three eyes in each, and these pieces were planted in rows two and a half feet apart, the sets being placed about a foot apart in the rows.

The potatoes were planted on May 28th and were dug October 15th.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Bus.	Lbs.	Bus.	Lbs.		(For five years.)	Bus.	Lbs.	Bus.	Lbs.
1	Carman No. 1	314	10	184	48	17	Empire State	233	38	125	24
2	Dreer's Standard	299	38	151	48	18	Irish Cobbler	226	10	123	12
3	Canadian Beauty	294	48	149	36	19	Maule's Thoroughbred	225	17	125	24
4	Burnaby Mammoth	283	22	125	24	20	Early Rose	224	50	127	36
5	Late Puritan	280	17	138	36	21	Early White Prize	175	34	140	48
6	Holborn Abundance	279	50	169	24	22	Early Envoy	174	14	107	48
7	Sabean's Elephant	274	34	143	..	23	Bovee	155	19	129	48
8	Everett	263	7	156	12						
9	Rochester Rose	262	41	132	..		(For less than five years.)				
10	State of Maine	261	48	173	48						
11	Vick's Extra Early	258	43	143	..		Dooley (3 years)	241	16	217	48
12	Reeves' Rose	252	7	125	24		Vermont Gold Coin (3 years)	218	32	169	24
13	American Wonder	251	57	140	48		Morgan Seeding (3 years)	213	24	145	12
14	Uncle Sam	251	14	112	12		Dalmeny Beauty (2 years)	270	36	327	48
15	Country Gentleman	249	55	187	48		Ashleaf Kidney (2 years)	137	30	123	12
16	Money Maker	249	2	57	12						

The average crop in 1907 of the 28 varieties of potatoes on the Central Experimental Farm, was 148 bus., 22 lbs. per acre.

EXPERIMENTAL FARM, NAPPAN, N.S.

At the Experimental Farm at Nappan, Nova Scotia, the spring was cold and wet and consequently very backward. The earliest sowing of grain was on May 20th. There was good growing and ripening weather later in the season and notwithstanding much wet weather in September which was detrimental to the hay crop the grain crops were fairly good. Wheat and barley averaged about the same as last year, while oats gave much better returns than in 1906. Indian corn cut green for ensilage owing to unfavourable weather fell considerably short of an average crop. All field roots and potatoes gave liberal returns.

The plots of grain were one-fortieth of an acre. The yield per acre of the Indian corn, field roots and potatoes has been calculated from the crop obtained from two rows each 66 feet long.

SPRING WHEAT.

Fourteen varieties of spring wheat (exclusive of the durum wheats) were grown at the Nappan Experimental Farm. The wheat was sown May 20th, the seed being used at the rate of about one and one-half bushels per acre.

Experimental Farm, Nappan, N. S.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Preston*	30	16	109	35	20	10	Herisson Bearded	24	16	108	25	20
2	White Fife	30	16	112	28	20	11	Percy*	23	52	111	26	40
3	White Russian	29	44	112	36	40		(For less than 5 years.)					
4	Red Fife	29	16	111	23	40							
5	Pringle's Champlain	28	..	108	25	40							
6	Red Fern	28	..	109	40	40		Bishop* (3 yrs.)	29	7	107	22	40
7	Stanley*	27	32	111	28	..		Hungarian White (3 yrs.)	28	..	107	26	40
8	Colorado	25	48	107	23	20		Riga* (2 yrs)	27	20	107	27	40
9	Huron*	24	40	110	27	20							

The average crop in 1907 of the fourteen varieties of spring wheat on the Experimental Farm at Nappan, N.S., was 28 bushels 26 lbs. per acre.

DURUM OR MACARONI WHEAT.

The durum wheats do not usually give very heavy crops in the rather moist climates of Eastern Canada. They are also very unpopular with most millers. Farmers who grow any of these varieties should exercise great care to prevent them from becoming mixed with the standard sorts for flour making and should only grow such quantities as they require for feed or to meet special demands.

Four varieties of durum wheat were grown at Nappan. The seed was sown on May 20th at the rate of about one and three quarter bushels to the acre.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For less than 5 years.)	Bu.	Lbs	Days.	Bu.	Lbs.
1	Roumanian	22	8	110	32	..		Yellow Gharnovka (4 years)	19	10	107	25	20
2	Goose	20	30	109	24	40		Mahmoudi (4 years)	17	10	107	28	..

The average crop in 1907 of the four varieties of durum wheat on the Experimental Farm at Nappan, N.S., was 27 bushels 30 lbs. per acre.

EMMER AND SPELT.

Two varieties of emmer and two of spelt are here reported upon. The seed was sown on May 20th at the rate of about 120 lbs. to the acre. Common emmer is the grain sometimes referred to under the incorrect name of "Speltz."

Number.	Varieties tested.	Average yield.	Average days maturing.	Yield for 1907.	Number.	Varieties tested.	Average yield.	Average days maturing.	Yield for 1907.
	(For four years.)	Lbs.	Days.	Lbs.		(For four years.)	Lbs.	Days.	Lbs.
1	White Spelt	1,950	113	1,800	3	Common Emmer	1,385	106	1,860
2	Red Spelt	1,940	113	2,040	4	Red Emmer	1,110	112	1,280

The average crop in 1907 of the four varieties of emmer and spelt on the Experimental Farm at Nappan, N.S., was 1,745 lbs. per acre.

Experimental Farm, Nappan, N. S.

OATS.

Thirty-one varieties of oats tested at Nappan are here reported on.

The seed was sown on May 21st at the rate of about 2½ bushels per acre.

Number.	Varieties Tested.	Average Yield.		Average days maturing.	Yield in 1907.		Number.	Varieties Tested.	Average Yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Siberian	74	30	107	70	20	18	Golden Giant	64	20	111	77	22
2	Goldfinder	71	22	109	73	18	19	Abundance	64	8	105	72	12
3	Banner	70	24	104	74	4	20	White Giant	63	30	106	60	..
4	Twentieth Century	70	24	103	67	2	21	Kendal White*	63	20	106	74	24
5	Improved Ligowo	70	20	104	63	18	22	Kendal Black*	62	12	106	72	32
6	Joanette	69	22	103	68	28	23	American Beauty	62	8	106	71	6
7	Swedish Select	69	10	105	62	32	24	Wide Awake	61	14	105	61	6
8	Thousand Dollar	68	24	105	60	..	25	Tartar King	60	32	103	76	16
9	Golden Fleece	68	20	106	71	26	26	Columbus	60	4	106	65	30
10	Pioneer	68	8	102	68	8	27	Milford White*	58	..	106	74	4
11	Lincoln	68	4	105	61	26	28	Irish Victor	55	22	105	60	20
12	Improved American	67	30	106	75	10	29	American Triumph	54	4	111	63	18
13	Sensation	67	6	104	62	12							
14	Bavarian	66	16	105	67	2		(For less than 5 years.)					
15	Black Beauty	65	26	103	71	26							
16	Golden Beauty	65	10	105	71	26		Storm King (4 yrs)	54	9	102	65	30
17	Danish Island	65	2	106	67	22		Virginia White (2 yrs)	58	8	104	68	8

The average crop in 1907 of the thirty one varieties of oats on the Experimental Farm at Nappan, N.S., was 68 bushels 16 lbs. per acre.

BARLEY.

Fifteen sorts of six-rowed barley and thirteen sorts of two-rowed, grown at Nappan in 1907 are here mentioned.

These plots were all sown on May 22nd the seed being used at the rate of about two bushels per acre.

SIX-ROWED BARLEY.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mensury	48	24	95	41	32	10	Nugent*	40	4	97	35	..
2	Empire*	45	40	96	40	40	11	Yale*	40	..	97	33	16
3	Oderbruch	45	20	93	37	24	12	Mansfield*	38	20	97	38	20
4	Albert*	44	16	94	34	8	13	Claude*	38	12	94	31	32
5	Stella*	44	16	99	38	16	14	Champion	35	40	92	27	24
6	Trooper*	43	12	94	33	16							
7	Odessa	43	12	93	35	40		(For less than 5 years.)					
8	Argyle*	41	12	95	40	..							
9	Summit*	40	20	99	28	16		Blue Long Head (2 yr).	38	16	99	36	32

The average crop in 1907 of the fifteen varieties of six-rowed barley on the Experimental Farm at Nappan N.S. was 35 bushels 24 lbs. per acre.

Experimental Farm, Nappan, N. S.

The seed was sown on June 14th and the crop was cut green for ensilage on October 23rd.

Number.	Varieties tested.	Average Yield.		Yield in 1907.		Number.	Varieties tested.	Average Yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Eureka	19	1,820	13	730	14	Champion White Pearl	15	1,790	11	1,430
2	Red Cob Ensilage	19	16	11	1,870	15	Mammoth Cuban	15	1,780	12	750
3	Early Mastodon	18	1,840	12	1,300	16	Cloud's Early Yellow	15	988	8	1,600
4	Salzer's All Gold	18	1,334	12	1,850	17	North Dakota White	15	712	9	1,910
5	Giant Prolific Ensilage	18	850	13	950	18	White Cap Yellow Dent	14	1,810	8	1,820
6	Longfellow	17	1,702	11	1,650						
7	Superior Fodder	17	320	10	900		(For less than 5 years.)				
8	Angel of Midnight	17	194	9	1,580						
9	Selected Leaming	16	1,770	10	570		Early Leaming (2 years)	17	100	11	1,650
10	Pride of the North	16	1,330	8	1,600		Early Longfellow (2 years)	16	65	13	180
11	Early Butler	16	1,000	11	550		Wood's Northern Dent (2 years)	13	950	10	1,450
12	Compton's Early	16	824	9	1,030						
13	King Philip	16	748	10	570						

The average crop in 1907 of the twenty one varieties of Indian corn on the Experimental Farm at Nappan was 11 tons 283 lbs. per acre.

TURNIPS.

Twelve varieties of field turnips tested at Nappan in 1907 are here reported upon. The seed was sown in drills two feet apart and the young plants thinned out to about 10 or 12 inches apart in the rows. The seed was sown on June 1st and the roots were pulled on November 9th.

Number.	Varieties tested.	Average Yield.		Yield in 1907.		Number.	Varieties tested.	Average Yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede	37	1,344	29	575	7	Halewood's Bronze Top	35	302	30	60
2	Magnum Bonum	36	1,420	29	80	8	Hall's Westbury	34	1,847	32	1,175
3	Jumbo	36	1,270	30	225	9	Carter's Elephant	34	873	31	1,525
4	Good Luck	36	765	34	1,465	10	Mammoth Clyde	34	136	26	1,295
5	Kangaroo	36	642	31	1,855	11	Skirvings	33	1,046	28	100
6	Hartley's Bronze	35	449	28	265	12	Bangholm Selected	32	1,355	26	635

The average yield in 1907 of the twelve varieties of turnips on the Experimental Farm at Nappan, N.S., was 29 tons 1,771 lbs. per acre.

MANGELS.

Ten varieties of mangels were tested at Nappan in 1907. The seed was sown in drills two feet apart and the young plants were thinned out to 10 or 12 inches apart in the rows. The seed was sown on June 1st and the roots were pulled on October 26th.

Experimental Farm, Nappan, N. S.

Number.	Varieties tested.	Average Yield.	Yield in 1907.	Varieties tested.	Average Yield.	Yield in 1907.
	(For five years.)	Tons. Lbs.	Tons. Lbs.	(For less than 5 years.)	Tons. Lbs.	Tons. Lbs.
1	Yellow Intermediate	33 124	36 1,425	Mamm. Red Intermediate (1 year).....	26 1,295	26 1,295
2	Giant Yellow Intermediate	32 468	38 1,385	Crimson Champion (1 year)...	26 800	26 800
3	Half Sugar White..	29 1,895	31 1,525	Perfection Mamm. Long Red (1 year).....	25 1,480	25 1,480
4	Prize Mamm. Long Red...	29 1,019	32 1,175			
5	Selected Yellow Globe....	28 1,303	28 925			
6	Giant Yellow Globe..... .	27 1,505	27 450			
7	Gate Post	25 704	36 600			

The average yield in 1907 of the ten varieties of mangels on the Experimental Farm at Nappan, N.S., was 28 tons 1,059 lbs. per acre.

CARROTS.

Six varieties of field carrots were tested at Nappan in 1907. The seed was sown in drills two feet apart and the young plants were thinned out to about 4 or 5 inches apart in the rows. The seed was sown on June 15th and the roots were pulled on October 26th.

Number.	Varieties tested.	Average yield.	Yield in 1907.	Number.	Varieties tested.	Average yield.	Yield in 1907.
		Tons. Lbs.	Tons. Lbs.			Tons. Lbs.	Tons. Lbs.
1	Ontario Champion.....	19 423	17 815	4	Half Long Chantenay. ...	17 73	16 505
2	Giant White Vosges.....	18 780	15 30	5	White Belgian..... ...	16 1,823	14 50
3	Mamm. WhiteIntermediate	18 452	14 1,700	6	Improved Short White...	16 906	16 835

The average yield in 1907 of the six varieties of carrots on the Experimental Farm at Nappan, N.S., was 15 tons 1,322 lbs. per acre.

SUGAR BEETS.

Three varieties of sugar beets were tested at Nappan in 1907. The seed was sown in drills two feet apart and the young plants thinned out to about 4 or 5 inches apart in the rows. The seed was sown on June 1st and the roots were pulled on October 26th.

Number.	Varieties tested.	Average yield.	Yield in 1907.	Number.	Varieties tested.	Average yield.	Yield in 1907.
	(For five years.)	Tons. Lbs.	Tons. Lbs.		(For five years.)	Tons. Lbs.	Tons. Lbs.
1	Wanzleben.	17 900	15 195	3	French Very Rich	14 1,516	12 1,575
2	Vilmorin's Improved	17 276	13 730				

The average yield in 1907 of the three varieties of sugar beets on the Experimental Farm at Nappan, N.S., was 13 tons 1,500 lbs. per acre.

Experimental Farm, Nappan, N.S.

POTATOES.

Twenty-eight kinds of potatoes grown at Nappan are here mentioned.

For planting, the potatoes were cut into pieces with two or three eyes in each, and these pieces were planted in rows two and a half feet apart, the sets being planted about a foot apart in the rows.

The potatoes were planted on June 3rd and were dug October 9th.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Bus.	Lbs.	Bus.	Lbs.		(For five years.)	Bus.	Lbs.	Bus.	Lbs.
1	Vick's Extra Early.....	474	19	532	24	17	Country Gentleman.....	334	24	367	24
2	Rochester Rose.....	432	58	576	24	18	American Wonder.....	325	36	396	..
3	Everett.....	388	58	561	..	19	Uncle Sam..	322	5	299	12
4	Late Puritan.....	383	14	484	..	20	Bovee	311	58	303	36
5	Empire State.	369	10	418	..	21	Dreer's Standard	299	12	349	48
6	Holborn Abundance.....	368	43	490	36	22	Early Rose.....	298	19	358	36
7	Carman No. 1.....	365	12	470	48	23	Reeve's Rose	279	50	374	..
8	Burnaby Mammoth.....	363	53	455	24						
9	State of Maine	362	17	323	24		(For less than five years.)				
10	Canadian Beauty.....	355	58	479	36						
11	Irish Cobbler.....	354	53	301	24		Vermont Gold Coin (3 yrs.).	519	56	543	24
12	Money Maker..	350	53	407	..		Dooley (3 yrs.).	435	36	473	..
13	Early White Prize.....	342	46	433	24		Morgan Seedling (3 yrs.)...	404	48	433	24
14	Early Envoy...	342	46	341	..		Ashleaf Kidney (3 yrs.)....	398	12	409	12
15	Maule's Thoroughbred....	336	10	396	..		Dalmeny Beauty (2 yrs.)...	307	54	334	12
16	Sabean's Elephant.....	334	50	363	..						

The average crop in 1907 of the twenty-eight varieties of potatoes on the Experimental Farm at Nappan, N.S., was 416 bushels 58 lbs. per acre.

EXPERIMENTAL FARM, BRANDON, MANITOBA.

At the Experimental Farm at Brandon, the spring work was much delayed by cold and wet weather. The first spring wheat was not sown until the 9th of May, which was several weeks later than usual. Oats were not sown until May 20th, and barley May 27th. Notwithstanding this lateness in seeding, the crops under the influence of more favourable weather made rapid progress and matured before serious frost. The trial plots of wheat gave an average of 38 bush. 8 lbs. per acre, oats 114 bush. 24 lbs., six-rowed barley 64 bush. 1 lb. and two-rowed barley 63 bush. 17 lbs. per acre. Indian corn and field roots have given about an average crop and potatoes a yield above the average.

The plots of grain were one-twentieth of an acre each. The yield per acre of the Indian corn and field roots has been calculated from the crop obtained from two rows each 66 feet long. In the case of potatoes one row 66 feet long has been used.

Experimental Farm, Brandon, Man.

EMMER AND SPELT.

Two varieties of emmer and two of spelt are here reported upon. The seed was sown on May 10th at the rate of about 120 lbs. to the acre. Common emmer is the grain sometimes referred to under the incorrect name of "Speltz."

Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1907.	Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1907.
	(For four years.)	Lbs.	Days.	Lbs.		(For four years.)	Lbs.	Days.	Lbs.
1	Common Emmer.....	3,405	126	2,820	3	Red Emmer.....	2,552	130	1,930
2	Red Spelt....	2,655	129	1,940	4	White Spelt.....	1,995	129	1,720

The average crop in 1907 of the four varieties of emmer and spelt on the Experimental Farm at Brandon, Man., was 2,103 lbs. per acre.

OATS.

Thirty one of the varieties of oats tested at Brandon are here reported on. The seed was sown on May 20th at the rate of about two bushels to the acre.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Improved American..	119	28	110	125	..	18	Irish Victor.....	107	8	108	110	30
2	Golden Giant.....	117	12	115	126	6	19	Black Beauty.....	104	18	108	114	14
3	Banner	116	4	111	128	28	20	Twentieth Century...	102	30	109	104	4
4	Danish Island.....	116	..	111	130	..	21	Kendal White*	102	20	110	104	24
5	White Giant.....	115	30	110	126	26	22	Joanette.....	102	6	111	127	2
6	Golden Beauty.....	115	20	111	125	20	23	Pioneer	100	2	108	96	16
7	Abundance.....	113	20	111	110	20	24	Tartar King	99	30	107	90	20
8	Lincoln....	113	2	110	122	2	25	Kendal Black *.....	96	30	114	122	2
9	Siberian	112	4	112	115	20	26	Sensation.....	96	16	109	109	24
10	Wide Awake.....	111	28	112	104	14	27	Improved Ligowo....	94	16	108	105	20
11	Columbus	110	32	110	122	2	28	Milford White*.....	90	26	112	109	14
12	American Triumph...	110	28	112	116	26	29	Swedish Select.	85	..	107	99	4
13	Goldfinder.....	110	18	112	127	32							
14	Bavarian	110	18	111	119	4		(For less than 5 years.)					
15	Golden Fleece.	109	32	108	121	16							
16	American Beauty.....	108	30	109	100	30		Storm King (4 yrs.). .	99	7	109	111	6
17	Thousand Dollar.....	108	26	109	109	14		Virginia White (2 yrs.)	102	32	105	117	32

The average crop in 1907 of the thirty-one varieties of oats on the Experimental Farm at Brandon was 114 bushels 24 lbs. per acre.

BARLEY.

Fifteen sorts of six-rowed barley and thirteen sorts of two-rowed barley were grown at Brandon in 1907. These plots were all sown on May 27th the seed being used at the rate of about two bushels per acre.

Experimental Farm, Brandon, Man.

SIX-ROWED BARLEY.

Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Odessa	64	40	88	71	12	10	Argyle*	58	24	91	63	26
2	Yale*	64	18	90	65	20	11	Albert*	57	20	89	59	28
3	Mensury	63	40	90	63	36	12	Stella*	56	32	91	63	16
4	Mansfield*	62	16	91	67	24	13	Trooper*	53	20	91	50	30
5	Summit*	61	12	92	71	12	14	Champion	37	10	85	35	..
6	Empire*	60	30	91	70	20							
7	Claude*	60	24	90	75	20		(For less than 5 years.)					
8	Oderbruch	60	..	88	81	12							
9	Nugent*	60	..	90	54	8		Blue Long Head 3 yrs.	65	33	92	67	44

The average crop in 1907 of the fifteen varieties of six-rowed barley on the Experimental Farm at Brandon, Man., was 64 bushels 1 lb. per acre.

TWO-ROWED BARLEY.

Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Jarvis*	57	36	91	72	4	9	Sidney*	51	24	91	64	8
2	Standwell	56	16	95	79	8	10	Invincible	50	28	93	52	34
3	Gordon*	53	40	93	48	6	11	Logan*	50	4	93	59	28
4	Danish Chevalier	53	8	95	70	20	12	Beaver*	46	26	93	45	..
5	French Chevalier	52	16	95	67	44							
6	Dunham*	52	4	92	59	28		(For less than 3 years.)					
7	Canadian Thorpe	51	44	93	71	42							
8	Clifford*	51	44	92	54	8		SwedishChevalier,3yrs	62	37	95	78	36

The average crop in 1907 of the thirteen varieties of two-rowed barley on the Experimental Farm at Brandon, Man., was 63 bushels 17 lbs. per acre.

Experimental Farm, Brandon, Man.

PEAS.

Twenty varieties of peas were grown at Brandon in 1907. These plots were sown on May 15th, the quantity of seed used being from 2 to 3 bushels per acre depending on the size of the pea.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Mackay *	55	28	130	46	20	11	Wisconsin Blue	47	8	126	40	20
2	Early Britain	54	14	127	39	50	12	Black eye Marrowfat.	46	48	128	37	20
3	Victoria *	51	6	129	46	10	13	Chancellor	46	28	118	46	.
4	Arthur *	50	8	124	38	20	14	Archer *	45	58	133	38	20
5	Gregory *	49	56	129	48	20	15	Daniel O'Rourke	45	54	129	41	30
6	Picton *	49	46	129	43	40	16	Nelson *	45	48	126	46	20
7	Paragon * †	49	38	125	43	10	17	White Marrowfat	45	40	131	27	..
8	Golden Vine	49	22	126	41	20	18	Prince Albert	44	28	133	39	40
9	Prince *	48	36	132	44	..	19	Prussian Blue	44	22	123	36	50
10	English Grey	48	24	131	39	20	20	Agnes *	40	8	129	24	40

The average crop in 1907 of the twenty varieties of peas on the Experimental Farm at Brandon, Man., was 40 bushels 25 lbs. per acre.

INDIAN CORN.

Twenty-one varieties of Indian corn were tested at Brandon during 1907. They were sown in rows about three feet apart and the plants thinned out to 6 to 8 inches apart in the rows.

The seed was sown on June 6th, and the crop was cut green for ensilage on September 10th. This crop needs frequent cultivation throughout the summer to produce the best results.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Longfellow	21	1,468	20	1,778	14	Early Mastodon	18	366	19	214
2	Superior Fodder	20	1,950	17	452	15	White Cap Yellow Dent	17	1,270	17	56
3	Eureka	20	1,444	17	848	16	Cloud's Early Yellow	17	492	18	234
4	Angel of Midnight	20	944	20	510	17	Selected Leaming	17	294	20	788
5	Compton's Early	20	313	19	412	18	Mammoth Cuban	16	155	13	1,720
6	North Dakota White	19	1,376	20	1,382						
7	King Philip	19	1,059	21	966		(For less than five years.)				
8	Early Butler	19	861	19	16						
9	Champion White Pearl	19	610	15	690		Early Leaming (2 yrs.)	18	828	20	1,184
10	Salzer's All Gold	19	254	20	1,580		Wood's Northern Dent (2 years)	18	399	21	174
11	Giant Prolific Ensilage	19	108	18	1,422		Early Longfellow (2 yrs.)	16	835	14	1,502
12	Red Cob Ensilage	18	1,528	13	334						
13	Pride of the North	18	524	17	254						

The average crop in 1907 of the twenty-one varieties of Indian corn on the Experimental Farm at Brandon, Man., was 18 tons 786 lbs. per acre.

Experimental Farm, Brandon, Man.

TURNIPS.

Twelve varieties of field turnips were tested at Brandon in 1907. The seed was sown in drills two feet apart and the young plants thinned out to about 10 to 12 inches apart in the rows. The seed was sown on May 22nd and the roots were pulled October 28th.

Number.	Varieties tested.	Average Yield.		Yield in 1907.		Number.	Varieties tested.	Average Yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Good Luck	32	838	26	1,856	7	Bangholm Selected	29	1,822	25	1,216
2	Hall's Westbury	31	1,307	33	1,848	8	Carter's Elephant	29	1,136	26	1,328
3	Magnum Bonum	31	410	28	496	9	Jumbo	28	1,605	24	840
4	Perfection Swede	30	34	34	904	10	Skirvings	28	1,394	32	1,208
5	Hartley's Bronze	29	1,875	25	952	11	Halewood's Bronze Top	28	1,341	31	40
6	Mammoth Clyde	29	1,822	32	1,736	12	Kangaroo	26	1,434	24	1,632

The average yield in 1907 of the twelve varieties of turnips on the Experimental Farm at Brandon, Man., was 28 tons 1,838 lbs. per acre.

MANGELS.

Ten varieties of mangels were tested at Brandon in 1907. The seed was sown in drills two feet apart and the young plants were thinned out to 10 to 12 inches apart in the row. The seed was sown on May 22nd and the roots were pulled on October 23rd.

Number.	Varieties tested.	Average Yield.		Yield in 1907.		Varieties tested.	Average Yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.	(For less than 5 years.)	Tons.	Lbs.	Tons.	Lbs.
1	Prize Mamm. Long Red	32	1,578	27	1,704	Perfection Mamm. Long Red (1 year)	24	840	24	840
2	Half Sugar White	31	1,307	24	576	Crimson Champion (1 year)	20	128	20	128
3	Yellow Intermediate	30	1,987	23	992	Mamm. Red Intermediate (1 year)	17	1,640	17	1,640
4	Gate Post	30	826	26	536					
5	Selected Yellow Globe	28	74	22	1,408					
6	Giant Yellow Intermediate	27	437	23	1,520					
7	Giant Yellow Globe	25	794	19	16					

The average yield in 1907 of the ten varieties of mangels on the Experimental Farm at Brandon, Man., was 22 tons 1,936 lbs. per acre.

CARROTS.

Six varieties of field carrots were tested at Brandon in 1907. The seed was sown in drills, two feet apart and the young plants were thinned out to about 4 or 5 inches apart in the rows. The seed was sown on May 22nd and the roots were pulled on October 29th.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Improved Short White	26	888	24	400	4	Mamm. White Intermediate	22	528	20	700
2	Ontario Champion	24	1,280	20	480	5	White Belgian	20	1,052	15	1,900
3	Giant White Vosges	22	1,232	18	960	6	Half Long Chantenay	18	80	15	800

The average yield in 1907 of the six varieties of carrots on the Experimental Farm at Brandon, Man., was 19 tons 207 lbs. per acre.

Experimental Farm, Brandon, Man.

SUGAR BEETS.

Three varieties of sugar beets were tested at Brandon in 1907. The seed was sown in drills, two feet apart and the young plants thinned out to about 4 or 5 inches apart in the rows. The seed was sown on May 22nd and the roots were pulled on October 23rd.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Wanzleben.....	22	141	18	1,224	3	French Very Rich.....	17	690	13	1,984
2	Vilmorin's Improved.....	17	1,851	18	696						

The average yield in 1907 of the three varieties of sugar beets on the Experimental Farm at Brandon, Man., was 16 tons 1,968 lbs. per acre.

POTATOES.

Twenty-eight kinds of potatoes grown at Brandon in 1907 are here mentioned.

For planting the potatoes were cut into pieces with two or three eyes in each and these pieces were planted in rows two and a half feet apart, the sets being placed about a foot apart in the rows. The potatoes were planted on May 23rd and were dug on October 10th and 12th.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Bus.	Lbs.	Bus.	Lbs.		(For five years.)	Bus.	Lbs.	Bus.	Lbs.
1	Late Puritan.....	572	22	509	40	17	Everett.....	431	56	454	40
2	State of Maine.....	563	12	550	..	18	Early Envoy.....	419	50	544	30
3	Uncle Sam.....	562	50	533	30	19	Early White Prize.....	397	6	460	10
4	Dreer's Standard.....	549	26	361	10	20	Vick's Extra Early.....	372	54	394	10
5	Money Maker.....	548	10	489	30	21	Early Rose.....	370	20	390	30
6	American Wonder.....	545	36	463	20	22	Bovee.....	368	8	220	..
7	Empire State.....	523	14	485	50	23	Rochester Rose.....	358	14	339	10
8	Sabean's Elephant.....	519	34	445	30						
9	Maule's Thoroughbred.....	512	14	460	10		(For less than 5 years.)				
10	Holborn Abundance.....	506	..	495	..						
11	Canadian Beauty.....	503	4	392	20						
12	Country Gentleman.....	502	20	425	20		Morgan Seedling (3 years).	532	17	423	30
13	Reeves' Rose.....	499	24	421	40		Vermont Gold Coin (3 yrs).	521	53	447	20
14	Irish Cobbler.....	477	2	438	10		Dooley (3 years).....	377	40	366	40
15	Carman No. 1.....	470	48	421	40		Ashleaf Kidney (2 years)..	383	10	425	20
16	Burnaby Mammoth.....	437	4	352	..		Dalmeny Beauty (2 yrs.)..	320	50	330	..

The average crop in 1907 of the twenty-eight varieties of potatoes on the Experimental Farm at Brandon, Man., was 427 bus., 53 lbs. per acre.

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

The unfavourable character of the season has resulted in injury to the wheat grown at Indian Head. The cold and backward weather made seeding very late, and low temperatures and wet weather during the ripening period interfered seriously with the rapid progress towards maturity, which grain in that district usually makes. There

were slight frosts on the nights of August 3rd and August 21st, when the standard thermometer at the Experimental Farm registered 35 F. and 33 F. respectively. Some slight injury was done to a few of the more tender flowers and vegetables but no harm was done to the grain. On September 12th two degrees of frost were registered and on September 21st three degrees. Prior to this heavy rains had fallen and low temperatures prevailed so that for two weeks the grain scarcely made any progress in ripening. The frost of the 12th was preceded by a rain of 20 hours during which 1·25 inches fell. This frost under such conditions no doubt did considerable injury which was further aggravated by the frost of the 21st when the temperature fell below freezing early in the evening and continued low all night.

With such an experience it is surprising that more serious injury was not done. The crop of the plots of spring wheat averaged 19 bush. 7 lbs. per acre as compared with 42 bush. 4 lbs. in 1906, and the effect of the frost could be plainly seen on most of the varieties. They have however a high percentage of germinating power, the 14 varieties under trial averaging 85 per cent, showing that they would make fair seed. The 31 varieties of oats under test this year gave a remarkably high average crop 110 bush. 20 lbs. per acre. The crops of barley both six-rowed and two rowed were excellent, and exceeded the average of last year by over six bushels per acre, while peas gave an average increase of about 5 bushels. With very few exceptions the germination of these numerous varieties is high and the weights per bushel show that the grain has been well matured. The weather was unsuitable for Indian corn and there was an average falling off in that crop of nearly 4 tons per acre. An average increase in field roots and potatoes however compensated for this.

The plots of grain were one-twentieth of an acre each. The yield per acre of the Indian corn and field roots has been calculated from the crop obtained from two rows each 66 feet long. In the case of potatoes one row 132 feet long has been used.

SPRING WHEAT.

Fourteen varieties of spring wheat (exclusive of the durum wheats) have been grown at the Indian Head Experimental Farm. The wheat was sown on May 6th, the seed being used at the rate of about one and one-half bushels per acre.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days	Bu.	Lbs.
1	Red Fern	39	39	133	15	40	10	Colorado	32	30	131	25	20
2	Preston*	37	58	130	23	20	11	Herisson Bearded	30	27	136	19	..
3	Stanley*	37	23	130	19	40							
4	White Fife	36	49	137	17	20		(For less than 5 years.)					
5	Percy*	36	27	130	21	40							
6	Huron*	36	25	129	21	..		Bishop* 3 years	36	47	130	23	20
7	Red Fife	34	59	137	12	..		Hungarian White 3 years	23	47	133	13	20
8	White Russian	33	56	134	15	20		Riga* 2 years	26	30	124	17	40
9	Pringle's Champlain	32	37	133	23	..							

The average crop in 1907 of the fourteen varieties of spring wheat on the Experimental Farm at Indian Head, Sask., was 19 bushels 7 lbs. per acre.

Experimental Farm, Indian Head, Sask.

DURUM OR MACARONI WHEAT.

While the durum wheats average usually heavier crops in the Canadian North-west than they do in Eastern Canada, they are very unpopular with most millers. Farmers who grow any of these varieties should exercise great care to prevent them from becoming mixed with the standard sorts for flour making, and should only grow such quantities as they require for feed or to meet special demands.

Four varieties of durum wheat were grown at the Indian Head farm in 1907. The seed was sown May 7th at the rate of about one and three quarter bushels to the acre.

Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1907.	Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1907.
	(For five years.)	Bu. Lbs.	Days.	Bu. Lbs.		(For less than 5 years.)	Bu. Lbs.	Days.	Bu. Lbs.
1	Goose	43 27	135	31 40		Yellow Gharnovka (4 yrs.)	43 55	135	29 20
2	Roumanian	42 50	136	31 ..		Mahmoudi (4 yrs.)	42 22	135	25 40

The average crop in 1907 of the four varieties of durum wheat on the Experimental Farm at Indian Head, Sask., was 29 bushels 25 lbs. per acre.

EMMER AND SPELT.

Two varieties of emmer and two of spelt were tested here. The seed was sown on May 13th at the rate of about 120 lbs. to the acre. Common emmer is the grain sometimes referred to under the incorrect name of "Speltz."

Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1907.	Number.	Varieties tested.	Average yield.	Average days maturing.	Yield in 1907.
	(For four years.)	Lbs.	Days.	Lbs.		(For four years.)	Lbs.	Days.	Lbs.
1	Common Emmer	2,820	129	2,020	3	White Spelt	2,295	131	1,560
2	Red Spelt	2,735	130	2,200	4	Red Emmer	2,215	131	1,320

The average crop in 1907 of the four varieties of emmer and spelt on the Experimental Farm at Indian Head, Sask., was 1,775 lbs. per acre.

OATS.

Thirty-one of the varieties of oats tested at Indian Head are here reported upon. The seed was sown on May 14th at the rate of about two bushels to the acre.

Experimental Farm, Indian Head, Sask.

TWO-ROWED BARLEY.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Invincible	65	10	111	54	28	10	Logan*	52	3	104	56	12
2	Standwell	64	17	110	59	8	11	French Chevalier	51	26	112	36	12
3	Danish Chevalier	59	32	112	58	16	12	Dunham*	45	29	107	48	16
4	Gordon*	57	7	105	54	28							
5	Canadian Thorpe	56	18	107	51	32		(For less than 5 years).					
6	Jarvis*	54	19	105	61	2							
7	Beaver*	54	9	111	51	32		Swedish Chevalier (3 years)	53	40	110	54	28
8	Sidney*	53	24	103	50	30							
9	Clifford*	52	40	104	53	36							

The average crop in 1907 of the thirteen varieties of two-rowed barley on the Experimental Farm at Indian Head, Sask., was 53 bushels 7 lbs. per acre.

PEAS.

Twenty of the varieties of peas grown at Indian Head are here reported upon. These plots were sown on May 20th, the quantity of seed used being from two to three bushels per acre depending on the size of the pea.

Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Early Britain	53	38	119	51	..	11	Archer*	49	10	121	40	..
2	Prussian Blue	52	54	118	47	40	12	Paragon*†	48	48	118	43	20
3	Golden Vine	51	42	116	48	.	13	Gregory*	48	18	121	45	40
4	Chancellor	51	22	116	51	40	14	Prince*	46	14	119	38	.
5	Black Eye Marrowfat	51	10	122	48	40	15	Wisconsin Blue	46	2	121	37	20
6	Daniel O'Rourke	51	6	116	49	20	16	Nelson*	45	46	118	38	20
7	English Grey	51	2	119	45	..	17	Arthur*	44	18	117	36	..
8	Mackay*	50	54	122	47	20	18	White Marrowfat	43	42	119	33	..
9	Picton*	49	34	118	38	40	19	Prince Albert	43	10	120	38	20
10	Agnes*	49	30	118	43	40	20	Victoria*	40	54	120	39	40

The average crop in 1907 of the twenty varieties of peas on the Experimental Farm at Indian Head, Sask., was 43 bushels 2 lbs. per acre.

INDIAN CORN.

Twenty-one varieties of Indian corn were tested at Indian Head in 1907. The seed was sown in rows about three feet apart, and the plants thinned out to 6 to 8 inches apart in the rows.

inches apart in the rows. The seed was sown May 27th and the roots were pulled on September 30th.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons	Lbs.	Tons	Lbs.		(For five years.)	Tons	Lbs.	Tons	Lbs.
1	Giant Yellow Intermediate	26	904	19	412	7	Gate Post	20	1,882	14	1,040
2	Half Sugar White	25	640	18	828		(For less than 5 years.)				
3	Selected Yellow Globe	24	835	13	1,192		Crimson Champion (1 yr.)	16	1,132	16	1,132
4	Giant Yellow Globe	24	606	17	188		Mamm. Red Inter. (1 yr.)	16	736	16	736
5	Yellow Intermediate	23	76	10	1,120		Perfection Mamm. Long Red (1 year)	16	208	16	208
6	Prize Mamm. Long Red	22	676	18	36						

The average yield in 1907 of the ten varieties of mangels on the Experimental Farm at Indian Head, Sask., was 16 tons 89 lbs. per acre.

CARROTS.

Six varieties of field carrots were tested at Indian Head in 1907. The seed was sown in drills two feet apart, and the young plants were thinned out to about 4 or 5 inches apart in the rows. The seed was sown on May 22nd, and the roots were pulled on October 11th. One of the varieties sown, the Mammoth White Intermediate did not germinate.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons	Lbs.	Tons	Lbs.		(For five years.)	Tons	Lbs.	Tons	Lbs.
1	Ontario Champion	15	324	12	552		The Mammoth White Intermediate carrot was also sown but failed to germinate.				
2	Half Long Chantenay	13	330	12	1,608						
3	Improved Short White	12	1,802	13	268						
4	Giant White Vosges	12	1.432	6	1,992						
5	White Belgian	11	1,390	6	1,200						

The average yield in 1907 of the five varieties of carrots on the Experimental Farm at Indian Head, Sask., was 10 tons 722 lbs. per acre.

SUGAR BEETS.

Three varieties of Sugar beets were tested at Indian Head in 1907. The seed was sown in drills two feet apart and the young plants thinned out to about 4 or 5 inches apart in the rows. The seed was sown on May 27th, and the roots were pulled on October 10th.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons	Lbs.	Tons	Lbs.		(For five years.)	Tons	Lbs.	Tons	Lbs.
1	Vilmorin's Improved	14	1,116	13	400	3	Wanzleben	13	1,625	11	704
2	French Very Rich	13	1,834	11	1,364						

The average yield in 1907 of the three varieties of sugar beets on the Experimental Farm at Indian Head, Sask., was 12 tons, 156 lbs. per acre.

Experimental Farm, Agassiz, B.C.

SPRING WHEAT.

The spring wheat plots, also the plots of durum wheat and of emmer and spelt at the Experimental Farm at Agassiz were so much injured by the wheat midge *Diplosis tritici* as to make the tests for 1906 as to the relative productiveness of the varieties of no value. In 1907 with the object of getting rid of this insect the plots of wheat were discontinued. Under the circumstances it is thought best to give here the average yields on the plots for the five years ending 1905.

Number.	Varieties tested.	Average Yield.		Number.	Varieties tested.	Average Yield.	
	(For five years ending 1905.)	Bu.	Lbs.		(For five years ending 1905.)	Bu.	Lbs.
1	Stanley*	35	14	7	Percy*	31	53
2	Colorado	34	14	8	Red Fern	30	27
3	White Russian	33	27	9	Huron*	30	26
4	Red Fife	33	9	10	Herisson Bearded	30	17
5	White Fife	32	47	11	Pringle's Champlain	28	52
6	Preston*	32	39				

DURUM OR MACARONI WHEAT.

Number.	Varieties tested.	Average Yield.		Average days maturing.	Varieties tested.	Average Yield.		Average days maturing.
	(For 5 years ending 1905.)	Bu.	Lbs.	Days.	(For 2 years ending 1905.)	Bu.	Lbs.	Days.
1	Roumanian	33	36	120	Mahmoudi	19	20	117
2	Goose	32	50	115	Yellow Gharnovka	18	..	117

EMMER AND SPELT.

In this instance the yield is expressed in pounds per acre, the grain being of course weighed with the husk adhering.

Number.	Varieties tested.	Average yield.	Average days maturing.	Number.	Varieties tested.	Average yield.	Average days maturing.
	(For two years ending 1905.)	Lbs.	Days.		(For two years ending 1905.)	Lbs.	Days.
1	Common Emmer	1,880	117	3	Red Emmer	1,660	117
2	White Spelt	1,775	117	4	Red Spelt	1,595	117

Experimental Farm, Agassiz, B. C.

TWO-ROWED BARLEY.

Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Standwell	53	24	111	57	24	10	Gordon*	47	12	108	47	24
2	Sidney*	52	24	111	52	24	11	Jarvis*	44	20	110	40	48
3	Dunham*	52	2	109	56	12	12	Logan*	44	16	109	39	28
4	Canadian Thorpe	51	38	109	48	36							
5	Beaver*	51	18	110	42	34		(For less than 5 years.)					
6	French Chevalier	50	28	111	41	32							
7	Danish Chevalier	50	24	111	53	16		Swedish Chevalier (3 years)	45	37	108	42	24
8	Invincible	49	20	110	48	16							
9	Clifford*	47	24	106	42	44							

The average crop in 1907 of the thirteen varieties of two-rowed barley on the Experimental Farm at Agassiz, B.C., was 47 bushels 13 lbs. per acre.

PEAS.

Twenty varieties of peas were grown at Agassiz in 1907. These plots were sown on April 18th the quantity of seed sown varying from two to three bushels per acre depending on the size of the pea, of the smaller sized peas two bushels are usually sufficient while the larger sorts require three bushels.

Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.		Number.	Varieties tested.	Average Yield.		Average days maturing.	Yield in 1907.	
	(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.		(For five years.)	Bu.	Lbs.	Days.	Bu.	Lbs.
1	Early Britain	45	6	110	47	10	11	Prince*	38	22	118	43	40
2	White Marrowfat	43	44	117	42	10	12	Gregory*	37	38	114	43	..
3	English Grey	42	4	114	41	20	13	Archer*	37	16	116	47	20
4	Chancellor	41	12	116	52	..	14	Prince Albert	37	16	116	40	40
5	Arthur*	39	58	116	46	50	15	Black eye Marrowfat	36	50	117	46	20
6	Golden Vine	39	38	115	48	..	16	Picton*	36	36	118	42	..
7	Wisconsin Blue	38	56	114	46	40	17	Daniel O'Rourke	36	14	110	34	..
8	Victoria*	38	52	118	36	..	18	Paragon*	36	..	119	44	..
9	Mackay*	38	40	116	40	..	19	Agnes*	35	40	118	43	20
10	Nelson*	38	36	116	50	.	20	Prussian Blue	33	26	113	36	20

The average crop in 1907 of the twenty varieties of peas on the Experimental Farm at Agassiz, B.C., was 43 bushels 33 lbs. per acre.

INDIAN CORN.

Eighteen varieties of Indian corn were tested at Agassiz in 1907. Two varieties tested at the other Experimental Farms, Early Leaming and Early Longfellow did not reach Agassiz in time for sowing. The seed was sown in rows about three feet apart, and the plants thinned out to 6 to 8 inches in the rows.

Experimental Farm, Agassiz, B. C.

The seed was sown on May 25th, and the crop was cut green for ensilage on October 12th. This crop needs frequent cultivation throughout the summer to produce the best results.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons.	lbs.	Tons.	lbs.		(For five years.)	Tons.	lbs.	Tons.	lbs.
1	Pride of the North	21	1,492	16	780	10	White Cap Yellow Dent	16	1,704	15	580
2	Giant Prolific Ensilage	19	1,160	17	100	11	Angel of Midnight	16	1,110	14	600
3	Superior Fodder	19	919	14	820	12	Eureka	16	952	22	200
4	Red Cob Ensilage	19	698	11	330	13	Early Mastodon	16	470	15	1,020
5	Compton's Early	19	539	17	1,200	14	King Philip	15	1,020	16	1,000
6	Mammoth Cuban	18	564	11	1,210	15	North Dakota White	15	756	11	440
7	Salzer's All Gold	17	1,842	11	1,320	16	Cloud's Early Yellow	14	1,994	18	1,620
8	Champion White Pearl	17	628	17	320	17	Longfellow	14	1,502	13	1,280
9	Early Butler	16	1,880	11	1,760	18	Selected Leaming	13	928	14	1,480

The average crop in 1907 of the eighteen varieties of Indian corn tested on the Experimental Farm at Agassiz, was 15 tons 114 lbs. per acre.

TURNIPS.

Twelve varieties of field turnips were tested at Agassiz in 1907. The seed was sown in drills two and a half feet apart and the young plants were thinned out to about 10 to 12 inches apart in the rows. The seed was sown on May 17th, and the roots were pulled on November 7th.

Number.	Varieties tested.	Average yield.		Yield in 1907.		Number.	Varieties tested.	Average yield.		Yield in 1907.	
	(For five years.)	Tons.	Lbs.	Tons.	Lbs.		(For five years.)	Tons.	Lbs.	Tons.	Lbs.
1	Perfection Swede	26	461	14	776	7	Jumbo	24	193	18	1,752
2	Halewood's Bronze Top	25	1,809	13	1,984	8	Hall's Westbury	23	596	15	1,680
3	Carter's Elephant	25	1,579	15	1,614	9	Magnum Bonum	23	398	15	360
4	Bangholm Selected	24	1,666	17	384	10	Kangaroo	23	253	15	1,416
5	Skirvings	24	708	14	1,172	11	Mammoth Clyde	22	946	17	1,772
6	Good Luck	24	226	13	1,324	12	Hartley's Bronze	21	1,247	16	76

The average yield in 1907 of the twelve varieties of turnips tested on the Experimental Farm at Agassiz, B. C., was 15 tons 1,526 lbs. per acre.

Experimental Farm, Agassiz, B. C.

MANGELS.

Ten varieties of mangels were tested at Agassiz in 1907. The seed was sown in drills two feet apart and the young plants were thinned out to 10 to 12 inches apart in the rows. The seed was sown May 1st, and the roots were pulled November 7th.

Number.	Varieties tested.	Average yield.	Yield in 1907.	Number.	Varieties tested.	Average yield.	Yield in 1907.
	(For five years.)	Tons. Lbs.	Tons. Lbs.		(For less than five years.)	Tons. Lbs.	Tons. Lbs.
1	Half Sugar White.....	23 1,791	25 160		Perfection Mammoth Long Red (1 year)..... ..	23 520	23 520
2	Yellow Intermediate.....	22 1,515	13 400		Crimson Champion (1 year).	14 512	14 512
3	Giant Yellow Globe.....	22 1,115	15 1,284		Mammoth Red Intermediate (1 year).....	12 1,212	12 1,212
4	Selected Yellow Globe.....	22 524	18 960				
5	Giant Yellow Intermediate.	21 1,225	22 1,352				
6	Prize Mamm. Long Red...	19 1,809	18 1,356				
7	Gate Post.....	19 1,593	19 1,336				

The average yield in 1907 of the ten varieties of mangels on the Experimental Farm at Agassiz, B. C., was 18 tons 709 lbs. per acre.

CARROTS.

Six varieties of field carrots were tested at Agassiz in 1907. The seed was sown in drills two feet apart, and the young plants were thinned out to about four or five inches apart in the rows. The seed was sown on May 1st, and the roots were pulled on November 7th.

Number.	Varieties tested.	Average yield.	Yield in 1907.	Number.	Varieties tested.	Average yield.	Yield in 1907.
	(For five years.)	Tons. Lbs.	Tons. Lbs.		(For five years.)	Tons. Lbs.	Tons. Lbs.
1	Giant White Vosges .. .	29 681	36 1,524	4	Mam. White Intermediate.	24 1,894	23 596
2	Ontario Champion	25 1,209	39 1,936	5	White Belgian.....	23 1,738	31 832
3	Improved Short White....	25 396	30 1,644	6	Half Long Chantenay	19 727	24 1,500

The average yield in 1907 of the six varieties of carrots on the Experimental Farm at Agassiz, B. C., was 31 tons 339 lbs. per acre.

EXPERIMENTAL FARM, LACOMBE, ALBERTA.

The site for an Experimental Farm for Northern Alberta at Lacombe, was chosen last year, but possession of the land was not obtained early enough in the season to permit of a complete series of trial plots being provided for, such as are sown from year to year at the older established experimental farms. No time however was lost in securing and forwarding such material as could be procured so as to make the series of plots as complete as was practicable. This being the first year that these trial plots have been sown at Lacombe, the results of 1907 only can be given.

The season was unfavourable, the spring cold and backward and the summer short. Frost occurred on the nights of August 10th and 21st, which injured the corn so that it shrivelled up and was ploughed under. The plots of peas also were badly injured so that their yields could not be determined. All varieties of wheat were more or less frosted and the later sorts were deficient in weight and low in vitality. Nevertheless the fourteen varieties under trial gave an average yield of 21 bush. 51 lbs. per acre.

Oats gave a good crop, the average yield of the thirty-one sorts tested was 86 bush. 31lbs. per acre and eight of these were above the standard in weight.

The 15 varieties of six-rowed barley averaged 57 bush. 26 lbs. per acre and the 13 varieties of two-rowed barley averaged 39 bush. 39 lbs. per acre. The field roots also did well. Fifteen varieties of turnips averaged 18 tons 642 lbs. per acre. Ten sorts of mangels 25 tons 799 lbs., six of carrots, 16 tons 1,479 lbs. and three of sugar beets 16 tons 1,264 lbs. per acre. Only 14 varieties of potatoes were tried and these were planted unusually late. They also suffered somewhat from frost, but their average yield was 152 bush. 58 lbs. per acre. In such an unusual season when some varieties failed to ripen completely it was impossible to determine accurately in every case the number of days from sowing to ripening hence this item of information is here omitted.

The plots of grain were one sixtieth of an acre each. The yield per acre of the field roots has been calculated from the crop obtained from two rows each 66 feet long.

SPRING WHEAT.

Fourteen varieties of spring wheat (exclusive of the durum wheats) have been grown at the Lacombe Experimental Farm in 1907. The wheat was sown on May 1st, the seed being used at the rate of about one and one-half bushels per acre.

Number.	Varieties tested.	Yield in 1907.	Weight per bushel.	Percentage of germination.	Number.	Varieties tested.	Yield in 1907.	Weight per bushel.	Percentage of germination.
	(For one year.)	Bu. Lbs.	Lbs.			(For one year.)	Bu. Lbs.	Lbs.	
1	Percy*	34 ..	52	67	8	Hungarian White	20 ..	47	42
2	Bishop*	33 ..	51	76	9	Pringle's Champlain	18 ..	46	51
3	Stanley*	31 ..	47	50	10	Huron*	17 30	47	87
4	Preston*	29 ..	49	65	11	Herisson Bearded	17 ..	48½	47
5	Colorado	25 ..	49	60	12	Red Fern	15 ..	42	15
6	Downy Riga*	23 30	55½	71	13	White Fife	13 ..	37½	9
7	White Russian	21 ..	42	34	14	Red Fife	9 ..	38½	9

The average crop in 1907 of the fourteen varieties of wheat on the Experimental Farm at Lacombe, Alta., was 21 bushels 51 lbs. per acre.

Experimental Farm, Lacombe, Alberta.

DURUM OR MACARONI WHEAT.

While the durum wheats average usually heavier crops in the Canadian Northwest than they do in Eastern Canada, they are very unpopular with millers. Farmers who grow any of these varieties should exercise great care to prevent them from becoming mixed with the standard sorts, and should only grow such quantities as they require for feed, or to meet special demands.

Four varieties of durum wheat were grown on the Experimental Farm at Lacombe. The seed was sown on May 1st at the rate of about 105 lbs. per acre.

Number.	Varieties tested.	Yield in 1907.	Weight per bushel.	Percentage of germination.	Number.	Varieties tested.	Yield in 1907.	Weight per bushel.	Percentage of germination.
	(For one year.)	Bu. Lbs.	Lbs.			(For one year.)	Bu. Lbs.	Lbs.	
1	Yellow Gharnovka ...	24 ..	44½	3	3	Roumanian	20 ..	45½	31
2	Goose	23 ..	45	51	4	Mahmoudi.	20 ..	40	24

The average crop in 1907 of the four varieties of durum wheat on the Experimental Farm at Lacombe, Alta., was 21 bushels 45 lbs. per acre.

EMMER AND SPELT.

Two varieties of emmer and two of spelt were tested at Lacombe. The seed was sown on May 1st, at the rate of about 120 lbs. per acre. Common emmer is the grain sometimes referred to under the incorrect name of "Speltz."

Number.	Varieties tested.	Yield in 1907.	Number.	Varieties tested.	Yield in 1907.
	(For one year.)	Lbs.		(For one year.)	Lbs.
1	Common Emmer.....	1,200	3	White Spelt.....	840
2	Red Spelt....	1,020	4	Red Emmer	540

The average crop in 1907 of the four varieties of Emmer and Spelt on the Experimental Farm at Lacombe, Alta, was 900 lbs. per acre.

Experimental Farm, Lacombe, Alberta.

CARROTS.

Six varieties of field carrots were tested at Lacombe in 1907. The seed was sown in drills two feet apart and the young plants were thinned out to about 4 or 5 inches apart in the rows. The seed was sown on May 29th, and the roots were pulled on October 22nd.

Number.	Varieties tested.	Yield in 1907.	Number.	Varieties tested.	Yield in 1907.
	(For one year.)	Tons. Lbs.		(For one year.)	Tons. Lbs.
1	Improved Short White	26 744	4	Half Long Chantenay	14 1,568
2	Ontario Champion	16 680	5	White Belgian	14 982
3	Giant White Vosges	16 680	6	Mamm. White Intermediate	12 222

The average yield in 1907 of the six varieties of carrots on the Experimental Farm at Lacombe, Alta., was 16 tons 1,479 lbs. per acre.

SUGAR BEETS.

Three varieties of sugar beets were tested at Lacombe in 1907. The seed was sown in drills two feet apart and the young plants thinned out to about 4 or 5 inches apart in the rows. The seed was sown on May 29th, and the roots were dug on October 21st

Number.	Varieties tested.	Yield in 1907.	Number.	Varieties tested.	Yield in 1907.
	(For one year.)	Tons. Lbs.		(For one year.)	Tons. Lbs.
1	Wanzleben	18 960	3	Vilmorin's Improved	15 1,152
2	French Very Rich	15 1,680			

The average crop in 1907 of the three varieties of sugar beets on the Experimental Farm at Lacombe Alta. was 16 tons 1,264 lbs. per acre.

POTATOES.

Fourteen varieties only of potatoes were grown at Lacombe in 1907. For planting, the potatoes were cut into pieces with two or three eyes in each and these pieces were

Experimental Farm, Lacombe, Alberta.

TWO-ROWED BARLEY.

Number.	Varieties tested.	Yield in 1907.		Weight per bushel.	Percentage of germination.	Number.	Varieties tested.	Yield in 1907.		Weight per bushel.	Percentage of germination.
	(For one year.)	Bu.	Lbs.	Lbs.			(For one year.)	Bu.	Lbs.	Lbs.	
1	Clifford*	50	..	49½	95	8	Sidney*	38	16	46	85
2	French Chevalier	46	12	44½	77	9	Invincible	37	24	42½	72
3	Gordon*	45	..	47½	91	10	Beaver*	36	42	46	88
4	Canadian Thorpe	45	..	41	58	11	Danish Chevalier	32	24	42	82
5	Dunham*	43	36	48	89	12	Jarvis*	31	12	46	90
6	Logan*	42	24	44½	92	13	Swedish Chevalier	28	36	36½	71
7	Standwell	40	..	40½	70						

The average crop in 1907 of the thirteen varieties of two-rowed barley on the Experimental Farm at Lacombe, Alta., was 39 bus., 39 lbs. per acre.

TURNIPS.

Twelve varieties of field turnips were tested at Lacombe in 1907. The seed was sown in drills two feet apart, and the young plants were thinned out to about 10 to 12 inches apart in the rows. The seed was sown on June 10th and the roots were pulled on October 23rd.

Number.	Varieties tested.	Yield in 1907.		Number.	Varieties tested.	Yield in 1907.	
	(For one year only.)	Tons.	Lbs.		(For one year only.)	Tons.	Lbs.
1	Hartley's Bronze Top	26	800	7	Jumbo	19	16
2	Good Luck	22	1,408	8	Halewood's Bronze Top	17	848
3	Kangaroo	22	1,408	9	Perfection Swede	14	1,024
4	Skirvings	22	352	10	Bangholm Selected	11	232
5	Mammoth Clyde	22	352	11	Magnum Bonum	11	16
6	Hall's Westbury	20	1,184	12	Carter's Elephant	10	64

The average crop in 1907 of the fifteen varieties of turnips on the Experimental Farm at Lacombe, Alta., was 18 tons 642 lbs. per acre.

MANGELS.

Ten varieties of mangels were tested at Lacombe in 1907. The seed was sown in drills two feet apart and the young plants were thinned out to 10 to 12 inches apart in the rows. The seed was sown on May 29th, and the roots were pulled on October 21st.

Number.	Varieties tested.	Yield in 1907.		Number.	Varieties tested.	Yield in 1907.	
	(For one year.)	Tons.	Lbs.		(For one year.)	Tons.	Lbs.
1	Giant Yellow Intermediate	32	1,528	6	Mammoth Red Intermediate	22	1,936
2	Giant Yellow Globe	28	1,552	7	Selected Yellow Globe	22	1,408
3	Half Sugar White	28	1,552	8	Prize Mammoth Long Red	20	1,184
4	Yellow Intermediate	28	1,024	9	Crimson Champion	20	1,184
5	Gate Post	28	1,024	10	Perfection Mammoth Long Red	19	1,600

The average yield in 1907 of the ten varieties of mangels on the Experimental Farm at Lacombe, Alta., was 25 tons 799 lbs. per acre.

UNIV. OF MICH.
JUL 20 1908

638.671
C-2-b

DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

ENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

THE FLAX PLANT

ITS CULTIVATION FOR SEED AND FIBRE

BY

WM. SAUNDERS, C.M.G., LL.D., F.R.S.C.
Director of Experimental Farms

BULLETIN No. 59

APRIL, 1908

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.
126—1

1 23
.E22

DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

THE FLAX PLANT

ITS CULTIVATION FOR SEED AND FIBRE

BY

WM. SAUNDERS, C.M.G., LL.D., F.R.S.C.
Director of Experimental Farms

BULLETIN No. 59

APRIL, 1908

Published by permission of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.
196—1

DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

THE FLAX PLANT

ITS CULTIVATION FOR SEED AND FIBRE

BY

WM. SAUNDERS, C.M.G., LL.D., F.R.S.C.

Director of Experimental Farms

BULLETIN No. 59

APRIL, 1908

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

126—1

To the Honourable

The Minister of Agriculture.

SIR,—I have the honour to submit for your approval Bulletin No. 59 of the Experimental Farm series, prepared by myself. In this bulletin the subject of flax is discussed, its cultivation both for seed and fibre, and information given as to the preparation of the land and the general treatment of this crop.

In view of the growing importance of the flax crop in Canada it seems desirable that our farmers should be placed in possession of such facts as may be helpful to them in this branch of agricultural industry.

I have the honour to be,

Your obedient servant,

WM. SAUNDERS,

Director Experimental Farms.

OTTAWA, April 3, 1908.

FLAX.

By Wm. Saunders, C.M.G., LL.D., F.R.S.C., F.L.S.

Director of Experimental Farms.

The cultivation of flax and the manufacture of its fibre date back to a very remote period. The great value of this plant has been known and appreciated for probably five thousand years past. The fact that the Egyptian mummies were wrapped in linen, shows that the use of the fibre of flax is very ancient. It was an old and well established industry in Egypt at the dawn of the Christian era. Some 3000 years ago the Phoenicians devoted much attention to the cultivation of this plant, and subsequently the Greeks and Romans made the working of flax fibre a part of the household duties.

This fibre, next to cotton, is the most valuable and universally employed textile in the whole range of vegetable fibres, and the plant can be grown in nearly every part of the world where the climate is temperate. It is cultivated to a considerable extent in Great Britain, Ireland, Sweden, Denmark, Holland, Belgium, France, Russia, Germany, Austria, Spain and Portugal. It is also grown over a large area in North America, and to some extent in portions of South America, notably in Argentina, where it is cultivated chiefly for its seed. It is still grown in Egypt, also in Algeria and Natal. Japan has entered on flax cultivation commercially, so also have the Australian colonies, where there is said to be a wide range of soil and climate favourable to its growth. In India also there are large areas devoted to the cultivation of the flax plant, but in that country it is grown chiefly for its seed.

CULTIVATION OF FLAX IN AMERICA.

Flax was brought to America by the early colonists, and the working of flax fibre was one of the earliest colonial industries, which was encouraged on every hand. Within the past hundred years it is said to have been a prevailing custom among farmers in the Eastern States to grow flax and to have it retted, scutched, hackled and spun by members of their household. A similar custom still prevails among some of the thrifty wives and daughters of the French-Canadian farmers in the rural districts of Quebec.

THE FLAX PLANT.

The flax plant of commerce received from the great botanist Linneus the name of *Linum usitatissimum*. From the generic name *Linum* the words linen, lint and linseed are derived, while the specific name *usitatissimum*, which means 'most useful,' was given to it in consideration of the service it has rendered the human family in supplying material for clothing.

Flax is an annual plant which grows from 20 to 40 inches in height or sometimes higher. The stem branches more or less, the number of branches depending largely on the quantity of seed sown and the relative closeness of the plants. The flower, when fully expanded, measures nearly an inch in diameter, and is usually of a purplish

blue colour, but varieties of the plant occur where the flowers are pink, flesh colour, or white. The plants bloom very freely, but the flowers are very fugitive, opening but once. Early in the morning when the flax is in flower the plot or field will be a mass of blue bloom, but before the day is far spent the flowers will have mostly withered and dropped. Each seed pod or boll has ten cells or divisions, each of which contains a single seed.

The seeds are flat, oval in form, of a dark brown colour, with a smooth polished surface. The outer portion of the seeds contain a mucilaginous material which dissolves freely in hot water, while the interior is very oily. When the seed is steeped for a time in hot water a mucilaginous beverage is made, known as flax seed tea, which is used as a soothing drink in some forms of inflammatory disease. The seed is said to contain about 15 per cent of mucilage and to yield from 22 to 27 per cent of oil, which is known in commerce as linseed oil and is largely used in the manufacture of paints. To obtain the oil the seed is ground and heated by steam and while hot is subjected to strong hydraulic pressure, when the oil flows freely from the pressed material. The cake left after the oil is extracted is known as oil cake, which when ground is much used as a food for cattle.

The fibre is that which gives to flax its greatest value. On cutting through a stem of this plant, the centre is found to be occupied by pith surrounding which is a layer of ordinary woody fibres, and outside of these is the inner bark which is formed of very long and remarkably tough fibres, the whole being covered by a skin or epidermis. The value of the plant depends on the abundance, length and quality of the fibre, and these characteristics can only be obtained where flax is grown in a suitable climate. The fibre of flax is very tough and is well adapted for spinning, and as compared with cotton, wool or silk is a good conductor of heat, linen clothing being proverbially cool.

GROWING FLAX FOR ITS FIBRE IN CANADA.

The cultivation of flax mainly for its fibre has been carried on in some parts of western Ontario for many years, the yield of seed under such circumstances being a secondary consideration. To grow flax successfully for fibre, a moist climate is said to be necessary, and in seasons when the rainfall is deficient the fibre produced is smaller in quantity and inferior in quality. The quantity of seed used in western Ontario when sowing flax for fibre is said to be about 80 lbs. per acre, which is sufficient to produce a thick growth, with the plants sufficiently close to give long and straight straw, which generally yields fibre of good quality. The seed is usually sown in Ontario during the last week of April or early in May, commonly by a broadcast machine or otherwise by hand, and the seed is covered by a light harrowing. Where flax is grown for its fibre it is always pulled in harvesting, as a longer fibre and a larger quantity can be obtained by this method. In some localities men are employed in pulling, while in others the larger part of this work is done by women and children. The pulling is done before the seed capsules are quite ripe, when they are just beginning to change from a green to a pale brown colour. As the crop is pulled it is tied in bundles or small sheaves which are placed for a time in stooks in the field, and when dry it is drawn to the storehouses. It is threshed by the use of a special machine which separates the seed without injuring the fibre in the straw and the straw is subsequently retted and scutched and the fibre thus prepared for market.

RETTING.

In retting or rotting as usually practised the dried flax is placed in ponds or dams of soft water, the water being about four feet deep. The stalks are tied in bundles and packed roots downwards in the ponds or dams until they are quite full. Over the top of the upper layer is placed a covering of straw and on this sufficiently weighty

substances are laid to keep the flax submerged. Fermentation soon begins with the evolution of gases and the decay of the soft vegetable tissue sometimes proceeds quite rapidly. After a few days the fermentation subsides and usually in from ten to fourteen days the process is complete. The time required for this operation varies with the temperature, but when it is found that the fibre when handled separates readily from the softened woody tissue, the small bundles are removed from the water and spread evenly over a grassy meadow. After being so exposed for about a fortnight advantage is taken of the first fine dry weather to gather up the flax, which is now ready for the next operation.

Various modifications of this process of retting have been proposed and put in practice, some involving the heating of the water, others the addition of various chemicals, all looking to the hastening of the process without injuring the material.

SCUTCHING.

This is the process by which the fibre is freed from the woody material still adhering to it after retting, and thus rendering it fit for the market. Various machines have been devised for this purpose, driven either by water or by steam power. These scutching mills are made and run with the object of producing the largest proportion of long clean fibre with the smallest amount of waste.

In Bulletin II of the Census of 1906, covering the manufactures of Canada, the following particulars relating to the production of dressed flax in this country are given:—

Number of establishments in which dressed flax is prepared 23 (22 of these are in Ontario).

Value of land, buildings and plant	$105,750
Working capital	115,000
Total wages paid	144,396
Value of product	241,932

From these figures it will be seen that the production of dressed flax cannot be classed among the important industries in Canada.

THE GROWING OF FLAX FOR SEED.

The growing of flax for its seed is a larger industry in this country. In the Census of Canada for 1900 the area under the cultivation of flax and the yields of seed in the several provinces are given for 1890 and 1900 as follows:—

—	1890.		1900.	
	Number of acres.	Number of bushels of seed.	Number of acres.	Number of bushels of seed.
Prince Edward Island	75	746	28	281
Nova Scotia	83	410	.....	58
New Brunswick	92	459	57	283
Quebec	2,878	29,476	1,881	19,309
Ontario	6,775	71,339	6,388	67,29;
Manitoba	6,089	34,588	14,404	81,898
Saskatchewan and Alberta	153	1,462	327	3,113
British Columbia	91	364	1	4
Totals for Canada	16,236	138,844	23,086	172,242

These figures show that there was a decrease in the number of acres under flax during the ten years from 1890 to 1900 in all the eastern provinces and in British Columbia, whereas in Manitoba there was a considerable increase, and a slight increase in Saskatchewan and Alberta.

The recent census of the Northwest provinces in 1906 shows remarkable increases in the production of flax seed in 1905 and 1906, especially in Saskatchewan; considerable increases also are shown in Alberta. In 1905 there was a lessened acreage of flax in Manitoba, but owing to a heavier crop that year there was an increase in the total quantity of flax seed harvested. In 1906 Manitoba showed an increase both in area and yield, and in the Manitoba crop report issued December 14, 1907, a further advance is shown with this crop:—

—	Number of acres of Flax.	Number of bushels of seed.	Yield per acre.
1905.			Bush. Lbs.
Total yield for the Northwest Provinces	45,812	608,242	13 27
Divided as follows—			
Manitoba	9,205	110,041	11 95
Saskatchewan	35,664	486,578	13 64
Alberta	943	11,623	12 32
1906.			
Total yield for the Northwest Provinces	131,819	1,818,780	13 79
Divided as follows—			
Manitoba	16,501	227,796	13 80
Saskatchewan	108,834	1,504,814	13 82
Alberta	6,484	86,170	13 28
1907.			
From Manitoba Crop Report, Dec. 14, 1907—			
Manitoba	25,915	317,347	12 25
The final report on grain crops for 1907 published by the Government of the province of Saskatchewan, Feb. 20, 1908, gives the figures for 1907 as follows	125,029	1,364,716	10 91

The provincial report for Alberta is not yet received.

Flax seed, as already stated, is chiefly used in the manufacture of linseed oil. There are three large linseed oil mills in Montreal, one at Baden, Ontario, and one at Winnipeg. The combined capacity of these mills is large and all the oil they manufacture finds a market in the Dominion. The demand indeed exceeds the supply, and the flax seed produced in Canada has to be supplemented by large importations, and considerable quantities of linseed oil are also brought in from other countries. The oil cake left after the oil is expressed, so highly esteemed as a nourishing food for cattle, is partly used in Canada and partly exported to Great Britain.

CAN THE FLAX STRAW PRODUCED IN THE NORTHWEST PROVINCES OF CANADA BE PROFITABLY WORKED FOR ITS FIBRE?

In 1896 experiments were conducted with flax at the several Dominion Experimental Farms for the purpose of ascertaining whether flax fibre could be profitably produced in the different climates of Canada where these experimental farms are located, also to gain further information as to the quantity of seed which should be sown per acre, and the best time for sowing.

A sufficient quantity of seed of the best sort obtainable—grown one year in this country after importation from Russia—was secured from J. Livingston, Esq., of Baden, Ontario, who was largely interested in the flax industry in Canada, being a manufacturer both of fibre and oil. Each experimental farm was supplied with seed from this source. Instructions were sent with the seed to select enough land in a

good condition of tilth and as uniform in character as possible, to provide for eight $\frac{1}{40}$th acre plots. Two of these plots were to be sown early in the season at each farm, and two on the same day each week following for four sowings, thus making the sowing period cover three weeks. The quantity of seed to be used at each sowing was at the rate of 40 lbs. per acre for one of the plots, and 80 lbs. per acre for the other. Directions were also given that when the flax had reached that degree of maturity when about one-third of the seed was ripe, the flax on one half of each plot was to be pulled and tied in small bundles and when cured in the field the weight of the straw ascertained. On the other half of each plot the seed was to be allowed to ripen, and then harvested and threshed to find out the yield. Arrangements were also made for packing and forwarding a bale of 50 lbs. weight of the pulled flax from each plot to Messrs. J. & J. Livingston, of Baden, Ontario, to be retted and scutched and the quantity and quality of the fibre in each case ascertained. These experiments in cultivation were conducted at the Central Experimental Farm at Ottawa, and at the Branch Farms at Nappan, N.S., Brandon, Man., Indian Head, Sask., and at Agassiz, B.C.

The instructions given were carefully carried out, and the 400 lbs. of pulled and cured flax sent to Baden, Ont., from each farm. At the conclusion of the test the Messrs. Livingston reported that the flax grown at Nappan, Ottawa and Agassiz had produced a profitable proportion of fibre of good quality, but that the samples grown at Brandon and Indian Head had given but a small yield of fibre, which was of poor quality. Their opinion was that the fibre produced from the flax grown on these two latter farms was not sufficient to pay the cost of working.

PRODUCTION OF CURED FLAX FOR FIBRE AT OTTAWA.

The heaviest yield of pulled flax grown at Ottawa—7,878 lbs. per acre—was gathered from a plot which had 80 lbs. of seed per acre, sown on May 7. The second heaviest crop was also had from a plot sown with seed at the rate of 80 lbs. per acre, sown on May 14. The pulled flax in this instance weighed 6,657 lbs. per acre. The average weight of pulled straw from the four plots sown with 80 lbs. of seed per acre was at the rate of 6,379 lbs. per acre, while the four plots sown at the rate of 40 lbs. per acre gave an average of 5,616 lbs. of cured flax per acre.

AT NAPPAN, NOVA SCOTIA.

The heaviest yield of pulled flax grown at Nappan—8,200 lbs. per acre—was from a plot sown June 4, with 40 lbs. of seed per acre, and the second heaviest, 6,000 lbs. per acre, from one sown on May 28, with 80 lbs. per acre. The average weight of cured straw grown from the plots sown with 80 lbs. of seed per acre was 4,650 lbs. per acre, whereas the four sown with 40 lbs. per acre gave an average of 5,350 lbs. per acre.

AT BRANDON, MANITOBA.

The heaviest yield of pulled flax grown at Brandon—1,900 lbs. per acre—was from a plot sown on May 23, with 40 lbs. of seed per acre. The second heaviest, 1,270 lbs. per acre, was had from one sown June 6, with 80 lbs. of seed per acre. The average weight pulled and cured from the plots sown with 80 lbs. of seed per acre was 1,237 lbs. per acre, while the four plots sown with 40 lbs. of seed per acre gave an average crop of 1,327 lbs. per acre.

AT INDIAN HEAD, SASKATCHEWAN.

The heaviest weight of pulled flax, cured, grown at Indian Head—4,240 lbs. per acre—was obtained from a plot sown on May 23, with 80 lbs. of seed per acre. The second heaviest, 4,120 lbs. per acre, was from a plot sown May 30, with 80 lbs. of seed per acre. The average weight of pulled flax cured from the plots sown with 80 lbs. of seed per acre was 4,030 lbs. per acre, while the four plots sown with 40 lbs. per acre produced an average crop of 3,380 lbs. of cured flax per acre.

AT AGASSIZ, BRITISH COLUMBIA.

The heaviest weight of pulled flax cured grown at Agassiz—3,400 lbs. per acre—was produced by a plot sown on May 15, with 80 lbs. of seed per acre, the second heaviest, 3,280 lbs. per acre, was from a plot sown May 22, also with 80 lbs. of seed per acre. The average weight of the pulled flax cured from the four plots sown with 80 lbs. of seed per acre was 2,740 lbs., whereas the average weight of crop obtained from the four plots sown with 40 lbs. of seed per acre was 2,490 lbs.

These figures show that at Ottawa, Indian Head and Agassiz the plots sown with 80 lbs. of seed per acre gave the larger average weight of pulled flax per acre, while at Nappan and Brandon the advantage in weight was in favour of the plots sown with 40 lbs. of seed per acre.

FURTHER EXPERIMENTS IN GROWING FLAX FOR SEED.

As the evidence obtained in 1896 as to the small quantity and poor quality of the fibre obtainable from flax grown in the Northwest provinces of Canada was in harmony with the general opinion of experts who had worked with similar material in like climates in the Western States, it was regarded as conclusive and it was not thought necessary to continue the experiments further. These were continued, however, in growing flax for its seed for several years, using 40 and 80 lbs. of seed per acre with each of the four sowings made one week apart. In all the subsequent trials the straw was allowed to ripen then cut and threshed.

RESULTS OF EXPERIMENTS WITH FLAX GROWN FOR SEED.

—	Largest crop.		Seed sown per acre.	Date of sowing.	Second largest crop.		Seed sown per acre.	Date of sowing.	Average yield from 40 lbs. seed per acre.		Average yield from 80 lbs. seed per acre.	
For four years at Ottawa, Ont.	Bush.	lbs.	lbs.		Bush.	lbs.	lbs.		Bush.	lbs.	Bush.	lbs.
1896	17	8	40	May 14	15	15	80	May 14	13	31	12	11
1897	10	30	40	May 26	9	26	40	May 19	9	23	7	35
1898	13	42	80	April 25	13	12	40	April 25	9	33	12	51
1902	9	20	80	April 30	8	40	40	April 30	8	10	7	30
For two years at Nappan, N.S.												
1896	34	20	40	June 4	32	40	80	May 21	24	43	25	43
1899	21	30	80	May 18	21	30	80	June 1	16	53	19	53
For four years at Brandon, Man.												
1896	17	26	80	June 6	17	8	80	May 16	14	14	16	45
1897	14	16	80	June 2	12	48	80	June 9	10	52	12	38
1898	28	32	40	May 28	25	00	80	May 28	22	15	19	29
1900*	7	8	40	May 12	6	44	80	May 12	6	19	6	24
For four years at Indian Head												
1896	13	12	80	May 23	12	48	80	May 16	10	25	12	13
1897	13	30	40	May 25	13	10	80	May 18	10	27	12	24
1898	22	00	80	May 28	16	00	80	May 21	11	22	17	10
1899	21	10	80	June 9	21	00	80	May 26	18	26	19	21
For three years at Agassiz, B. C.												
1896	12	8	80	May 22	12	8	80	May 15	7	28	8	52
1899	18	32	40	May 19	17	48	40	May 12	16	4	15	20
1900	11	4	80	April 24	9	16	80	May 1	7	28	8	54

* The season of 1900 was a very unfavourable one in Manitoba, owing to severe spring frosts and a very unusual drought.

These results seem to indicate that when flax is sown for its seed only, the sowing of 40 lbs. of seed per acre does not always produce as heavy a crop as where 80 lbs. is sown. The yields of seed obtained from the four years tests at Brandon show an average difference of 23 lbs. per acre in favour of the 80 lbs. of seed, while at Indian Head the heavier sowing has increased the crop to the extent of 2½ bushels per acre. These experiments, however, were conducted on land which had been under crop for several years, and this may have made some difference in the results. On new breaking the general opinion drawn from experience is that 40 lbs. of seed per acre is sufficient. With regard to the best time for sowing in the Northwest provinces, from the middle to the end of May is usually recommended. The seed selected for sowing should be plump, well developed, of good colour and free from the seeds of weeds. Where large fields are sown the seeding is usually done with the drill.

Some further trials have been made in the growing of flax seed at the Indian Head and Brandon farms, using the following proportions of seed:—

Seed sown per acre.	Indian Head. — Years sown.	Average crop.		Brandon. — Years sown.	Average crop.	
lbs.		Bush.	lbs.		Bush.	lbs.
20	4 yrs. 1901-4-5-6	15	27	1 yr. 1901	11	14
30	4 yrs. 1901-4-5-6	17	28	1 yr. 1901	11	14
40	5 yrs. 1901-2-4-5-6	21	13	2 yrs. 1901-3	17	48
50	2 yrs. 1904-5	14	1	1 yr. 1903	18	32
60	1 yr. 1902	16	16	1 yr. 1903	22	28
70				1 yr. 1903	21	4
80				1 yr. 1903	20	20
90				1 yr. 1903	19	36
100				1 yr. 1003	17	48

Judging from the crops produced and the quality of the seed grown it is evident that the conditions in the Northwest provinces of Canada are favourable for the production of flax seed. As in the United States, the greatest development of this industry is in the Northwest. In that country, with its annual product varying from twenty-five to nearly thirty million bushels, North Dakota produces about one-half of the entire crop, while if the product of South Dakota and Minnesota be added these three states contribute more than three-fourths of the total production.

In the United States the average yield of flax seed per acre for the five years ending 1907 was 9·6 bushels.

The production of flax seed in Canada has not yet been sufficient to meet the demands of the oil mills. Hence large quantities are imported from the United States and from Argentina. The quantity brought into Canada during 1906 was about 500,000 bushels. Besides this a large quantity of linseed oil is imported which could be profitably made here if the crop of home grown seed were sufficiently large. The Canadian government has, in the interest of Canadian agriculture, imposed a duty of ten cents per bushel on flax seed, and as long as the demand so largely exceeds the supply there is a great inducement to farmers to take up the sowing of flax on a larger scale.

SOIL AND TREATMENT.

A deep and well tilled soil in a good condition of fertility, but at the same time not too heavy, is well suited for flax. Indeed soil which is in fit condition to produce a good crop of grain may be successfully used for growing flax. In most flax growing countries this crop is grown as one in a regular rotation, the crops forming the rotation being so arranged as to meet the conditions of the farmer and to bring the flax into the regular series of crops once in four or five years. A common rotation

in the flax growing countries is said to be oats, rye, wheat, clover and flax. Clover is regarded as one of the best crops to precede flax as its roots penetrate deeply into the soil and bring up stores of fertility from below which many other plants do not reach. Clover also assimilates and stores up nitrogen from the air, and when ploughed under furnishes much of this important element for the crop that is to follow. Flax can also be grown on the prairie soils of the Northwest on new breaking, but usually produces a heavier crop on backsetting, or on a clean fallow. To make this clear to those who are unacquainted with the methods of prairie farming it may be said that the first breaking of prairie sod is generally made by turning over a wide and shallow furrow about two inches thick, when this is done in the spring the land is ready for backsetting early in the autumn, by which is meant a second ploughing the furrows running across the breaking to a depth of about four inches. This cuts the decayed sod, turns it over and covers it with about two inches of fresh soil from below. In many parts of the Northwest provinces backsetting is the usual preparation for a wheat crop. After turning the sod over where flax is to be sown it should be lightly worked with a disc harrow setting the harrow so as to cut the earth fairly well but not so as to tear up the sod. The seed is then sown and the land rolled so as to press the sod firmly in its place. Many farmers break the land deeper, from three to four inches, then disc harrow, sow and roll. Where flax is sown on new breaking a seed bed comparatively free from weeds is provided, which is a great advantage for a flax crop. The farmer also derives some revenue from this part of his land the first year and the crop effectually rots the sod so as to admit of ploughing to the ordinary depth in the autumn.

A DISEASE IN FLAX.

A disease known as 'flax wilt' has attracted considerable attention in the Northwestern States. This disease is said to be due to a fungoid growth. It manifests its presence by the wilting of the young plants as if caused by drought or intense heat. It occurs in spots in the fields, which at first are limited to three or four feet in diameter, but if the disease is unchecked these gradually increase in size until finally the whole crop may be affected. Flax wilt occurs most commonly where flax has been grown in successive crops on the same land, when the land is said to become flax sick. This shows the importance of paying attention to the rotation of this crop with others. No reports of the occurrence of 'flax wilt' in the Canadian Northwest provinces have yet been reported to us, but it is not likely we shall long escape this malady unless it can be avoided by strict attention to a proper rotation.

IS FLAX A SPECIALLY EXHAUSTING CROP?

This question is usually answered in the affirmative, but this opinion does not appear to be warranted by the chemical analyses which have been made of this crop, showing the principal elements of fertility taken from the soil during the period of its growth. The results which have been obtained by chemical examination have furnished the following figures, which represent approximately the plant food removed from the soil by flax, wheat and oats:—

An acre of flax producing 15 bushels of seed and 2,000 lbs. of straw, takes from the soil—

——	Nitrogen.	Phosphoric Acid.	Potash.
	Lbs.	Lbs.	Lbs.
For the seed, 840 lbs.	26	14·86	9·28
" straw, 2,000 lbs.	20	9·00	28·00
Total	46	23·86	37·28

If we compare this with a crop of wheat yielding 25 bushels of grain per acre and 2,200 lbs. of straw, we find that the wheat takes from the soil—

——	Nitrogen.	Phosphoric Acid.	Potash.
	Lbs.	Lbs.	Lbs.
For the grain, 1.500 lbs..	28·50	12·68	8·54
" straw, 2,200 lbs.	12·03	4·96	20·57
Total	40·53	17·64	29·11

If we compare the figures given of the analyses of flax with those of a crop of oats of 50 bushels to the acre with 2,200 lbs. of straw, we find that there is taken from the soil by the oat crop—

——	Nitrogen.	Phosphoric Acid.	Potash.
	Lbs.	Lbs.	Lbs.
For the grain, 1,700 lbs.	32·13	10·48	8·05
" straw, 2,200 lbs.	13·90	4·74	24·83
Total	46·03	15·22	32 88

The larger part of the straw of all these crops grown in the Northwest is usually burnt, when the mineral ingredients taken from the land are returned to it in the form of ashes. In the east, where the straw is utilized chiefly for bedding animals, the mineral constituents taken up are returned to the soil with the manure, hence the seed only need be considered. It will be seen that the grain, in the case of the wheat crop, takes up a little more nitrogen and somewhat less of phosphoric acid and potash than is taken by the flax seed; while the oat crop takes for the grain a larger proportion of nitrogen, nearly one-third less of phosphoric acid and about one-eighth less of potash. The difference, however, in exhaustive effect of these several crops on a rich soil would scarcely be perceptible, and would not justify the opinion that flax is a very exhausting crop. In some experiments tried at the Experimental Farm at Brandou, Man., during the year 1895, in sowing wheat, oats and barley after flax, the results obtained point to the same conclusion.

THE IMPROVEMENT OF FLAX BY SELECTION.

At the Central Experimental Farm the tests of different varieties of flax have been found unsatisfactory owing to the mixed character of the different kinds. The Cerealist is now engaged in propagating a number of selected strains so as to obtain varieties which shall be really distinct and homogeneous. Some of the new selections will, it is expected, be an improvement on the original mixtures from which they were obtained.

OTTAWA, March, 1908.

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

THE GRADES OF WHEAT

IN THE

MANITOBA INSPECTION DIVISION

CROP OF 1907

PART I

BY

Chas. E. Saunders, Ph. D.,

Cerealist

PART II

BY

Frank T. Shutt, M. A.,

Chemist of the Dominion Experimental Farms

BULLETIN No. 60

APRIL, 1908

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa.

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

THE GRADES OF WHEAT

IN THE

MANITOBA INSPECTION DIVISION
CROP OF 1907

PART I

BY

Chas. E. Saunders, Ph. D.,
Cerealist

PART II

BY

Frank T. Shutt, M.A.,
Chemist of the Dominion Experimental Farms

BULLETIN No. 60

APRIL, 1908

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa.

To the Honourable

THE MINISTER OF AGRICULTURE.

SIR,—I have the honour to submit for your approval Bulletin No. 60 of the Experimental Farm series, on "The Grades of Wheat in the Manitoba Inspection Division Crop of 1907." The first part of this Bulletin "On the Milling and Baking Qualities of the Grades of Wheat" has been prepared by Dr. Charles E. Saunders, Cerealist. The second part, "A Chemical Study of the Grain and Flour of the Grades of Wheat," has been prepared by the Chemist of the Experimental Farms, Mr. Frank T. Shutt.

Part I. contains descriptions of the samples and particulars in reference to the cleaning and milling of them; also, of the percentage of straight flour made from each. The results of the Baking tests are also given. In Part II. are presented the details of the analyses of the various grades of wheat, both as received and as cleaned for milling. The analyses of the flours are also submitted with much useful information regarding their several constituents.

The subject of wheats and their quality, as grown in Canada, is one of much importance to the country, and it is hoped that the information contained in this bulletin concerning the results of the research work done on this important cereal in the laboratories of the Central Experimental Farm will mark a distinct step in the advancement of our knowledge of this subject.

I have the honour to be,

Your obedient servant,

WM. SAUNDERS,
Director of Experimental Farms.

OTTAWA, April 6, 1908.

PART I.

THE MILLING AND BAKING QUALITIES OF THE GRADES OF WHEAT IN THE MANITOBA INSPECTION DIVISION, CROP OF 1907.

By CHAS. E. SAUNDERS, B.A., Ph. D., *Cerealist.*

Owing to the unusual character of the summer of 1907, it seemed desirable to study the various grades of wheat somewhat after the plan adopted when dealing with the crop of 1904 (Bulletin No. 50) in order to determine, as far as possible, whether the wheat in the higher grades was in any way affected by the coolness of the season, and also to ascertain the relative values of the lower grades (Nos. 4, 5 and 6), which were established by the Western Grain Standards Board to provide for the proper classification of such lots of wheat as showed more or less striking defects due to frost, water, premature cutting, &c.

When dealing with the crop of 1904, the work was undertaken rather late in the winter and the samples used for study were forwarded to us from Winnipeg by Mr. David Horn, Chief Inspector of Grain, from the large lots under his charge, representing the *averages* of the grades. In the present investigation it was thought desirable to begin the work much earlier. We, therefore, made use of a set of "official samples," dated October, 1907, and received at Ottawa in sealed bags on November 13th, from the Secretary of the Western Grain Standards Board.

In answer to an inquiry in regard to the exact significance of these samples, Mr. David Horn wrote "The type samples represent the different grades as they can leave Fort William. They represent the minimum in quality and the maximum in impurities. Millers would of course clean and purify to meet the needs of their trade."

Though these were composite samples, and thus strictly representative, it must be noted that they were somewhat lower in quality than those used from the crop of 1904; because, of course, the *average* of each grade is necessarily higher than the *legal minimum.* It is fair to suppose, therefore, that the average quality of each grade this season would be about midway between the figures here obtained and those of the grade next higher.

The samples received were as follows:—

No. 1 Manitoba Hard.
No. 1 Manitoba Northern.
No. 2 Manitoba Northern.
No. 3 Manitoba Northern.
Commercial Grade, No. 4.
Commercial Grade, No. 5.
Commercial Grade, No. 6.
Commercial Grade, Feed.

The grade last mentioned is sometimes referred to as No. 1 Feed.

Descriptions of the Samples as Received.

The samples of the different grades were received in excellent condition. The impurities present in the wheat consisted of wild oats, oats, barley, flax, smut balls, weed seeds, chaff, bits of straw, &c. Every grade had some "smut-balls," but there were not many

in any of the samples. The higher grades had so very few that they could fairly be said to be, in a commercial sense (for milling), quite free from smut. For seed purposes it would, perhaps, be unsafe to use even No. 1 Hard without some treatment to destroy the smut spores.

No. 1 Manitoba Hard.—This sample consisted almost altogether of hard red, plump kernels, very few soft kernels being present. Careful counting showed about three immature, shrunken kernels in every hundred. Practically free from "frosted" kernels, that is, kernels with pale, roughened skin, due to the action of frost or water, or both. No appreciable odour of smut.

No. 1 Manitoba Northern.—Distinguished from No. 1 Hard chiefly by the larger proportion of starchy kernels present, and of kernels which are somewhat shrivelled. Has about ten shrunken kernels in every hundred. Practically free from kernels showing action of water or frost. No appreciable odour of smut.

No. 2 Manitoba Northern.—Very much like No. 1 Northern, but with a slightly larger proportion of defective kernels. Contains about twelve defective kernels in every hundred, about eleven of these being shrunken and one plump, but with a rough skin due to the action of water or frost. No appreciable odour of smut.

No. 3 Manitoba Northern.—Contains about twenty-three defective kernels in every hundred, about twenty being shrunken (some showing also the effect of water or frost), and three being plump, but with the skin affected by water or frost. Very slight odour of smut.

Commercial Grade No. 4.—Contains about thirty defective kernels in every hundred. Of these about 27 are shrunken (some showing also the effect of water or frost), and three are fairly plump, but affected by water or frost. Slight odour of smut.

Commercial Grade No. 5.—Contains about fifty-six defective kernels in every hundred. Of these about forty are shrunken (many showing also the effect of water or frost), and sixteen are fairly plump, but affected by water or frost. Slight odour of smut.

Commercial Grade No. 6.—Contains about sixty-five defective kernels in every hundred Of these about fifty are shrunken (most of them showing also the effect of water or frost), and fifteen are fairly plump, but affected by water or frost. Distinct odour of smut.

Commercial Grade, Feed.—Contains about eighty-eight defective kernels in every hundred. Of these about sixty-three are shrunken (most of them showing also the effect of water or frost), and twenty-five are fairly plump, but affected by water or frost. Distinct odour of smut.

Cleaning and Milling of the Samples.

Before milling, the wheat was cleaned by sifting and hand picking until nearly free from oats, barley, weed seeds, &c., the cleaning being carried to about the same extent as in ordinary milling practice. In addition to kernels of other grains, weed seeds, &c., the material removed contained a considerable proportion of very small, shrunken wheat kernels and fragments of kernels.

The method of milling was essentially the same as that used in previous investigations, and fully described in Bulletins 50 and 57. The effort was made to put into the "straight grade" flour all the material which could fairly be said to be fit for bread-making, and at the same time to keep the colour of the flour from the lower grades as close as practicable to the standard of the upper grades. The low grade flour, shorts and bran were not determined separately. The yields of flour are expressed as percentages of the total products obtained. There was a loss in milling of about two per cent of the material ground.

It should be mentioned that in an experimental flour mill working with small quantities of wheat, the yield of flour must always be sacrificed, to a certain extent, if a fair standard of colour is to be maintained. The yields published are intended, therefore, to show the *relative* values of the grades for the production of good flour, and do not show the total quantity of such flour obtainable from each grade in large mills.

The following table shows the weight of a measured bushel of each sample as received, the loss in cleaning, and the weight of a measured bushel after cleaning; also the yield of break flour and of straight grade flour. It seemed unnecessary to make any flour from Feed wheat.

Milling Number.	Grade.	Weight per bushel as received.	Loss in cleaning.	Weight per bushel after cleaning.	Break flour.	Straight Grade flour.
		Lbs.	Per cent.	Lbs.	Per cent.	Per cent.
160	No. 1 Manitoba Hard.....	62½	.9	62¾	9½	65
162	No. 1 Manitoba Northern....	61½	2.3	61¾	10	62½
163	No. 2 Manitoba Northern....	61	2.5	61½	10	62
165	No. 3 Manitoba Northern....	59½	3.7	60	9	59½
166	Commercial Grade, No. 4....	58	4.5	58¾	8	56
168	Commercial Grade, No. 5....	58	3.2	58½	7½	56
169	Commercial Grade, No. 6....	56	3.5	57½	6	50½
.....	Commercial Grade, Feed.....	54	.....	.....	.....	.....

Colour of Flour.

In the dry condition the straight grade flours from the three upper grades appeared identical in colour. No. 3 Northern, No. 4 and No. 5, gave flour of almost uniform colour, but somewhat less bright than that from the higher grades. The flour from No. 6 was slightly duller than any of the others.

After being moistened and dried all the flours were, of course, darker in colour, but fell naturally into the same three groups as before.

Since the commercial value of flour is so much affected by colour (quite apart from the question of baking strength,) it is evident that the flour from No. 3 Northern, No. 4 and No. 5 would be of somewhat less value per pound than that from the upper grades; while the flour obtained from No. 6 would bring a still lower price.

Baking Tests.

The milling tests of the grades were completed on December 5th, 1907. The baking tests were postponed until early in January, 1908, so that the samples of flour might come to a fairly uniform character in regard to moisture content, and be baked under the usual conditions which are maintained in this laboratory. Furthermore, although very little is known in regard to the improvement of wheat and flour by keeping, it seemed probable that unfair and misleading results might be obtained if the baking tests were made before either the wheat or flour had been allowed any reasonable chance to improve with age.

Full details in regard to the method of baking, and the manner in which the figures for baking strength and bread value are computed have been given in Bulletin No. 57 of the Experimental Farm Series. They need not, therefore, be repeated here. Two slight changes require to be mentioned, however.

As it is not always possible to keep the samples of flour together for a sufficiently long period to bring them to about the same moisture content, and as even in mid-winter the weather of one season is sometimes different from another, it has seemed necessary to adopt some standard for the amount of moisture normally present in flour at the time the tests are usually made (mid-winter) in this laboratory. Eight per cent has been taken as the standard for moisture. The variations from that figure are usually negligable if the flour has been kept for a few weeks under our normal mid-winter conditions. Where particular accuracy is required, or where the moisture content is considerably greater or less than eight per cent, the figures actually obtained in the baking tests are recalculated to that basis.

The method of determining volume of loaf has been improved by the use of rape seed, instead of flax, and by direct measurement of the seed instead of calculating its volume from its weight. It was found that the weight of a given volume of flax seed varied according to age, moisture in the atmosphere, &c. A fairly constant error due to this method of determining volume was present in the figures published in Bulletin 57, though the results of each season were quite sufficiently accurate among themselves. In order to prevent the correction in the determinations of volume (which are now somewhat lower than before) from shifting downward the whole scale of marks for baking strength, it has been found necessary to subtract 670 instead of 700 from the large total of marks obtained. (See Bulletin 57, page 18.) In this way the figures for baking strength in this and in future researches will be kept comparable with those already published.

The slight changes just mentioned will account for the discrepancy between some of the figures in the following tables and those published in the preliminary report of this work. which was given to the press as soon as the tests were completed.

In regard to volume of loaf, it should be noted that owing to the small size of the loaves made, their proportion of crust is relatively large. It follows, therefore, that the actual lightness of the interior is greater in these small loaves than in larger loaves which give the same figures for volume (from each 100 grammes of flour.)

BAKING TESTS, JANUARY, 1908.

Milling Number.	Grade.	Water added to 100 grammes of flour.	Water retained by 100 grammes of flour.	Volume of loaf from 100 grammes of flour.	Height of loaf divided by diameter.	Form of Crust.	Texture.	Inside Colour.	Time of fermentation.	
									H.	M.
160	No. 1 Hard	65	41.5	492	.65	87	97	98	[illegible]	[illegible]
162	No. 1 Northern	66.5	44.5	443	.61	94	95	96	3	14
163	No. 2 Northern	66	44	438	.62	96	95	96	3	[illegible]
165	No. 3 Northern	67	46	383	.60	96	86	88	3	0
166	No. 4	68	46.5	397	.59	94	86	83	2	56
168	No. 5	68.5	47.5	366	.58	93	84	80	3	10
169	No. 6	69	47	363	.59	98	81	70	3	24

BAKING STRENGTH AND BREAD VALUE.

Milling Number.	Grade.	Baking strength.	Bread value.	Remarks
160	No. 1 Hard	95	96	Lowest in the series in water adsorption but highest in volume.
162	No. 1 Northern	91	92	Almost identical with No. 2 Northern.
163	No. 2 Northern	91	92	Almost identical with No. 1 Northern.
165	No. 3 Northern	83	84	Much lower in volume than the highest grades, also of poorer colour.
166	No. 4	84	84	Very slightly superior to No. 3 Northern in some respects, but inferior in colour.
168	No. 5	80	80	High in water absorption but dough is hard to work and quite sticky.
169	No. 6	80	78	Very much like No. 5 except in colour, which is much inferior.

Comments on Results.

An examination of the tables shows that the flours fall naturally into three groups.

The first group consists of the three upper grades (No. 1 Hard, Nos. 1 and 2 Northern) which yield strong flour of good colour and show a baking strength of over 90 points. The fact that No. 1 Hard absorbed less water than either of the other grades in the group is difficult to explain. The much smaller weight of the loaf produced is partly due to the fact that larger loaves dry out to a greater extent than smaller loaves (made from the same weight of flour) when baked in the same way.

The second group contains the two grades No. 3 Northern and No. 4. The flours obtained from these grades are of about equal value, but the yield was three and a half per cent greater from No. 3 Northern than from No. 4. They both give flour distinctly inferior to the upper grades in strength and colour; and in spite of their high water absorption they cannot be ranked as strictly first-class from the standpoint of the commercial baker. No doubt a certain amount of high grade flour could be obtained from No. 3 Northern but a good yield of such flour appeared impossible at the time when these tests were made. For the production of strong flour, wheat usually improves with age when stored under good conditions and it is therefore quite possible that the two grades here considered may show striking improvement in colour and strength of flour in the course of a few months from the date of the conclusion of these tests (January 17th). At the time this work was done these two grades yielded good household flour which should be satisfactory to anyone not requiring a product of high strength. While such flour would not command the highest price for mixing purposes it could probably be used to good advantage if blended with the product from some other types of wheat of quite different character.

The third group consists of the grades No. 5 and No. 6. The official standard samples of these grades as tested cannot be recommended for milling purposes, though it is probable that good flour can be made from some exceptional lots of No. 5, if the low grade has been given on account of the shrivelled skin of the wheat and not because the kernels were lacking in plumpness.

From the tests of these lower grades, and from similar tests of some other samples of "frosted" wheat which were studied this season, it appears that one should not expect to obtain good flour from badly "frosted" wheat weighing less than 60 lbs. to the measured bushel.

Crop of 1904 Compared with Crop of 1907.

The crop of 1904 (see Bulletin No. 50) was of an unusual character owing to the prevalence of rust. It was therefore to be expected that the grades of the past season would show some points of difference from those of 1904. The flours from the grades of 1904 showed a lower water absorption and a lower protein content than those of 1907 (see Part II, page 14) but gave bread of larger volume, especially in the lower grades. These observations perhaps justify the conclusion that wheat which is lacking in plumpness on account of the action of rust will produce better flour than wheat, of about the same degree of plumpness, which has been injured by frost.

PART II.

A CHEMICAL STUDY OF THE GRAIN AND FLOUR OF THE GRADES OF WHEAT—1907.

BY

FRANK T. SHUTT, M.A., F.I.C.

Chemist, Dominion Experimental Farms.

In this work the general plan of analysis followed has been that adopted at the present day in the more complete examination of wheat and flour and already outlined in Bulletin No. 50, of the Experimental Farm Series. This, in addition to furnishing data of an exhaustive character regarding the composition of the grain and flour, allows the more or less direct comparison of the data with the results obtained on similar samples from the grades of 1904 and given in the aforesaid bulletin.

In Bulletin No. 57, "Quality in Wheat" (Experimental Farm Series), in speaking of the components of flour which influence strength, the writer referred to recent work on this subject by Mr. T. B. Wood of the University of Cambridge. This investigator, accepting "strength" as applied to flour to be the capacity of forming "large and well-piled" loaves, puts forward the view that strength is determined by two separate factors—the one influencing the size or volume of the loaf, the other its shape, and presents certain data to support that view. We have been enabled to do some investigatory work in this new and interesting field and the results are presented and discussed in the chapter dealing with the flours of the grades.

Frozen or "Frosted" Wheat.

Before considering the data of the present research, it is desirable to say a word or two respecting the wheat crop of which the various grades are representatives. The season of 1907 was in many districts in the Canadian North-West extremely and exceptionally unfavourable to the production of first class grain. Heavy or continuous rains with low temperatures prevailed over large areas during a considerable part of the growing season, retarding the development of the wheat plant and the maturing of its seed. Unfortunately there followed in the early autumn injurious frosts, finding much of the grain still in the "dough" stage. The result of these conditions has been that large quantities of frozen or "frosted" wheat have been harvested, a considerable proportion of which was too immature and too badly injured to be useful for flour making, though, as our analyses and practical trials show, it has a distinct and indeed high feeding value for various kinds of stock.

The terms "frozen" and "frosted" as applied to wheat are employed indiscriminately, or apparently so, the extent of the injury being usually denoted by an adjective, such as badly or slightly. It does not seem desirable to use either term without some qualifying adjective, as the effect of frost may from the miller's standpoint, render a wheat valueless or on the other hand leave it practically unscathed. A wheat then may be seriously or only slightly injured, depending, it would seem, on one or both of two factors. The chief one undoubtedly is the stage of the growth of the wheat when caught by the frost, the less mature grain suffering most; but we must also suppose that the degree of frost to which the ripening wheat is subjected has its effect. Thus we find that when frost, though comparatively slight, occurs while the grain is still in the early "dough" stage, development is arrested and there results a small, shrunken, badly discoloured grain; on the other hand a more severe frost delayed until the berry is almost ripe may give a fairly plump grain of good colour, the indication of frost being noticeable only in its shrivelled skin. The effect of water on the skin of the grain is apparently very similar to that of frost.

The injury from frost or wet to the wheats under consideration is discussed in Part I (page 8), it will therefore be only necessary to say here that a casual examination of the grades shows an almost negligible proportion of kernels affected by frost or water in No. 3 Northern, and that the grades above this number appear to be free from such defective kernels. Grades below No. 3, and especially No. 6 and "Feed," show a large proportion of frosted and shrivelled grain.

Preparation of the Samples.

In the case of the first four grades the samples as analysed were prepared by a slight cleaning, (see Part I, page 8) by which was removed the greater portion of such foreign and accidental matter (chiefly oat and barley kernels) as might be present. This cleaning took out from .9 to 3.7 per cent and left the wheat suitable for general milling purposes.

To ascertain the extent to which the foreign matter present might influence the composition, grades Nos. 4, 5 and 6 were analysed as received and also after a preparatory cleaning as already outlined. These lower grades, naturally, contain a larger proportion of foreign matter than any of the first four members of the series. "Feed" was analysed only as received.

Composition of the Wheats.

Moisture.—The percentages of moisture are for the most part markedly higher than those which have been usually obtained in the analysis of North-Western wheats. This does not *necessarily* indicate, in the opinion of the writer, an exceptionally moist grain, due to immaturity or other causes; it is perhaps to be explained by the fact that previous analyses have for the most part been made later in the season and after the grain had lost moisture from exposure for a prolonged period to the excessively dry air of winter.

It is also to be remarked that it has been customary in previous work on wheat to determine the percentage of moisture on the finely ground grain as prepared for analysis. The results given in this bulletin are those obtained on the coarsely ground wheat. This, as experiment has shown, will give slightly higher percentages than if the determination is made on the fine powder, there being a loss of moisture, frequently amounting to between one and two per cent, in the final reduction in the mill. This fact led us to make separate grindings for the moisture determinations, and necessitated also moisture estimations on the finely ground wheat (as prepared for analysis) for the recalculation of the remainder of the analytical data to the basis of the original water content. The additional work which this involved is, we think, compensated for by the greater accuracy obtained.

ANALYSES OF WHEATS.

Designation of Sample.	Weight of 100 kernels.	Moisture.	Crude Protein. (N × 6 25)	Fat.	Carbo-hydrates.	Fibre.	Ash.
	Grammes.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
No. 1 Manitoba Hard*	2.895	13.02	13.68	1.98	67.50	2.21	1.61
No. 1 Manitoba Northern*	2.699	13.35	13.45	2.12	67.04	2.31	1.73
No. 2 Manitoba Northern*	2.309	12.99	13.41	2.13	67.37	2,37	1.73
No. 3 Manitoba Northern.*	2.760	13.42	14.09	2.06	66.46	2.31	1.66
Commercial Grade No. 4*	2.470	12.02	13.96	2.32	67.56	2.43	1.73
Commercial Grade No. 4†	.....	13.22	13.46	2.39	66.41	2.74	1 78
Commercial Grade No. 5*	2.610	12.33	13.81	2.33	67.42	2.40	1.71
Commercial Grade No. 5†	.....	10.98	14.08	2.41	68.09	2.65	1.79
Commercial Grade No. 6*	2.427	12.08	14.30	2.45	66.73	2.63	1.78
Commercial Grade No. 6†	.....	12.62	13.84	2.46	66.54	2.74	1.80
Commercail Grade No. 7†	2.371	13.45	12.20	2.44	66.84	3.10	1.97

* As cleaned for milling.

† As received.

Crude Protein.—In the calculation of this constituent, the most important in the wheat grain, the factor 6.25 for multiplying the total nitrogen in the grain has been employed. Recent research has shown that the factor 5.7 gives results nearer the truth, but as it has not yet come into general use, the older factor has been retained in the wheat analysis in order to make our data readily comparable with those already published on wheat from American sources. In the flour analysis the factor 5.7 has been used.

Viewed from the standpoint of protein content, the whole series ranks exceptionally high, and especially is this true considering the comparatively large percentages of moisture present. As the results stand the data show that the wheats of the grades of 1907 contain from 1 p.c. to 2 p.c. more protein than those of 1904 (*see* Bulletin No. 50, Experimental Farm Series); if the results of both seasons were calculated to the same moisture content the difference would be still greater. It seems more than probable that this high protein content may, in part at least, be attributable to the peculiarities of the last season, to which we have already referred. Though no doubt the wheat in many sections, as is usual, reached a full ripeness there is ample evidence that over large areas development was so checked by low temperatures and wet weather that much wheat made but little progress for weeks together and this appears to have been the case especially when the grain was in the dough stage. This wheat was harvested in a more or less immature condition and subsequent to cutting there was found to be very little filling out of the grain. This view of a high crude protein content as resulting from a certain degree of immaturity is quite consonant with the conclusions to be drawn from our studies on frozen wheats—which are necessarily immature wheats. Such are invariably high in crude protein (total nitrogen × 6.25), though as recent analyses have shown, a small part of these nitrogenous compounds are of a non-albuminoid character. The discussion of the wheats of the various grades from the standpoint of the effect of frost will be taken up in a succeeding paragraph.

Among the grades as used for milling purposes no very marked differences in protein content occur. The figures for the first three members of the series are practically within the limit of experimental error. "Feed" has a somewhat lower percentage of protein than the grades above it, due no doubt to the larger proportion of refuse it contains. Excepting this number the maximum difference is found to be .89 per cent.

We have already alluded to the investigations made, some years ago, in which the writer showed that frosted wheat was characterized by a higher protein content than similar wheat that had normally ripened, in other words, that frosted grain is in a measure immature grain and accordingly more nitrogenous than if the season had permitted the grain to become plump through the later deposition of starch. It may be asked, therefore, how far the present data support this view, since as we have already noticed, signs of frost (or wet?) are apparent in No. 3 Northern and increase somewhat from this number to the close of the list.

The evidence is as follows, from the cleaned samples.

—	Crude Protein.	—	Crude Protein.
	per cent.		per cent.
No. 1 Manitoba Hard	13.68	No. 3 Northern	14.09
No. 1 Northern	13.45	No. 4 Commercial Grade	13.96
No. 2 Northern	13.41	No. 5 Commercial Grade	13.81
		No. 6 Commercial Grade	14.30
Average protein-content in frost-free samples	13.51	Average protein-content in samples showing frost	14.04

Though perhaps not furnishing evidence of a very pronounced character the writer thinks the data strengthen the deduction reached from previous research respecting the higher percentages of protein in frosted and immature grain.

"Cleaning" as a rule raised the protein content, the exception being in the case of No. 5. The amount and the nature of the foreign material taken out, as for instance seeds or fragments of straw, would naturally determine the extent and direction of the change.

Feeding value of lower grades.—So far as can be determined by chemical analysis, we have in the lower grades wheat that should prove very valuable for feeding purposes, wheat characterized by what might be termed an exceptionally large percentage of that most valuable constituent protein.* There seems every reason to premise that, fed judiciously, frosted wheat will equal normally ripened wheat. Of course the proportion of foreign matter—offal—present will correspondingly reduce the feeding value and this fact must not be lost sight of when "feed" wheat is under consideration.

Fat.—No great differences are to be observed in the fat data, but it is interesting to note that the percentages of this constituent in the lower grades are somewhat higher than those of the first four members of the series. This perhaps may be construed as indicating more fat in the immature (frosted) grain than in that normally ripened. In 1904 we similarly found a higher fat content in the "frosted" and "feed" members of the series. This is a matter that will receive our further attention during the present season.

We have again to note, taking the series as a whole, that the percentage of fat is considerably higher in these wheats than in winter varieties—a fact of some importance from the nutritive standpoint.

Fibre and Ash.—There is nothing abnormal to be remarked respecting the data for fibre and ash, though the constantly increasing percentage of fibre as we proceed from the highest to the lowest grades, following the proportion of shrunken and shrivelled kernels, is to be noted. As might be expected the percentages of fibre and ash are invariably somewhat higher in the samples "as received" than in the wheats " as cleaned for milling". "Feed", owing to its large proportion of foreign matter presents the largest percentages of these constituents.

Weight of the Kernel.—Previous investigations with wheat of the same type have shown that the weight of the kernel bears a more or less definite relationship to the weight per bushel and the percentage of straight grade flour that may be obtained—the heavier the kernel the greater the weight per bushel and the larger the percentage of first grade flour. The results from the 1907 wheats do not show this relationship throughout the series. The data may be tabulated as follows:—

Designation of Sample.	Weight of 100 kernels.	Weight per bushel (after cleaning).	Yield pf straight grade flour. (See Part I.)
	Grammes.	Lbs.	Lbs.
No. 1 Hard	2.895	62¾	65
No. 1 Northern	2.699	61¾	62½
No. 2 Northern	2.309	61½	62
No. 3 Northern	2.760	60	59½
Commercial Grade No. 4	2.470	58¾	56
Commercial Grade No. 5	2.619	58½	56
Commercial Grade No. 6	2.427	57½	50½

The writer is inclined to think that the presence of "frosted" grain in the lower members of the series is the disturbing influence this year and furnishes in part, at least, the explanation for the lack of agreement between the weight of the kernel and yield of flour. The yield of straight flour is determined from the standpoint of colour, and frosted wheat furnishes a flour more or less dark or "off" colour, according to the extent of injury. Wheat

*A series of analyses recently made with the view of determining more correctly the nature of the nitrogenous compounds in frozen and immature wheat reveals the fact that a small proportion of the so called crude protein consists of non-albuminoid substances which, as is well known have a somewhat lower feeding value than true proteins.

but slightly touched with frost when almost ripe will yield a larger amount of good colour (straight) flour than one seriously frozen while still immature. It is evident, therefore, if the grades have been fixed chiefly by the degree or extent of frost showing (which will be relative to the amount of "straight" flour) rather than by other characteristics e. g. plumpness, size and weight, the direct relationship we have referred to as observed in former seasons, will in this series be upset and irregular.

Composition of the Flours.

Straight flours were prepared by the Cerealist from all the foregoing grades save "Feed" in the experimental roller mill. These furnished the samples used in the determination of the breadmaking values already given in Part I., and for the chemical work now about to be detailed, thus allowing the correlation of the two classes of data, as far as such may be practicable.

The chemical estimations include moisture, protein, fat, fibre, ash, wet and dry gluten, the proportion of protein in the form of gliadin and the nitrogen, ash and certain other constituents in the water-soluble extract of the flours.

ANALYSES OF FLOUR.

Designation of Sample.	Moisture.	Protein or albuminoids (N × 5.7).	Fat.	Carbohydrates.	Fibre.	Ash.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
No. 1 Hard	9.60	12.05	1.25	76.34	.17	.57
No. 1 Northern	9.15	12.18	1.36	76.47	.20	.64
No. 2 Northern	9.52	12.43	1.26	75.92	.21	.66
No. 3 Northern	9.32	11.97	1.48	76.38	.19	.66
Commercial Grade No. 4	9.37	12.60	1.47	75.78	.18	.66
Commercial Grade No. 5	9.45	12.43	1.37	75.86	.19	.70
Commercial Grade No. 6	9.41	12.03	1.47	76.11	.28	.70

Moisture.—The proportion of moisture in a flour is largely determined by the atmospheric conditions under which it is stored. It must not be supposed, therefore, that the percentages here recorded are those which would be found in flours from these grades upon the market; in such the probability is that the moistures would be considerably higher due to conditions of storage less favorable to the drying out of the flours. Flours in commerce usually contain from 11 p.c. to 13 p.c. moisture, varying to a certain degree with the season of the year, the air being more humid, and consequently the flour somewhat more moist, in the summer.

A noticeable feature is the uniformity in moisture content throughout the series, undoubtedly the result of previously submitting all the samples for a period of several weeks to the same atmospheric conditions. This uniformity allows the comparison of the analytical data generally without further calculation.

Protein or Albuminoids.—It has already been remarked that the wheats of these grades were characterized by a higher protein content than those of 1904. The same is true as regards the flours. In 1904 the average was 11.06, in the present series 12.24 per cent. Possibly this increased protein content does not indicate any marked increase in quality or strength, for it has not been found, invariably, that the bread making value of a flour is directly and simply dependent on the percentage of protein present: indeed as already hinted, it may be an indication of slight immaturity owing to the abnormal and backward season last year in many parts of the Northwest, and in such case we could not regard it as denoting any superiority, save perhaps from the nutritive standpoint.

No differentiation of the flours can be attempted from the standpoint of their protein content, by reason of the fact that the percentages of this constituent throughout the series

are extremely close; there is no marked departure from the average (12.24) obtained from the seven samples. It is commonly supposed that No. 1 Hard obtains this rank by virtue of being able to produce a flour with a larger percentage of protein and gluten, but neither the results from the 1904 grades (Bulletin 50, Exp. Farm Series) nor from the present series lend any support to that view.

Fat.—The percentages of this constituent are very similar to those obtained from the flours of the grades of 1904 (Bulletin 50, Exp. Farm Series), and furnish additional evidence of the richness in this nutritive element of flours from the Northwest wheats. The average percentage of fat, as obtained by the Division of Chemistry, Department of Agriculture, Washington, D.C., from the analysis of 40 samples of "patent" flour is given as 1.02; the average of the present results is 1.38 per cent.

GLIADIN, GLIADIN RATIO AND WET AND DRY GLUTEN.

Designation of Sample.	Gliadin.	Proportion of Albuminoids in the form of Gliadin.	Gluten.			
			Wet.	Dry.	Ratio of dry to wet.	Physical Character.
	per cent.	per cent.	per cent.	per cent.		
No. 1 Hard	5.43	45.1	41.73	14.94	2.80	Good.
" 1 Northern	5.29	43.4	41.12	14.65	2.81	"
" 2 "	5.57	44.8	42.15	15.27	2.69	"
" 3 "	5.03	42.0	39.54	14.04	2.81	"
Commercial Grade No. 4	5.06	40.2	41.27	14.62	2.82	"
" " " 5	4.91	39.5	39.38	13.43	2.93	"
" " " 6	4.88	40.6	38.33	13.89	2.79	Fair, sl. dark.

Gliadin and Gliadin Ratio.—The nature and value of these determinations have been fully considered by us in several recent publications and more particularly in Bulletin No. 57 on the "Quality of Wheat" October, 1907. It will not be necessary, therefore, here to enter upon any detailed discussion as to the bearing of these data on the bread making value of a flour.

It may suffice to say that the view that a good, strong flour should contain from 55 per cent to 65 per cent of its protein in the form of gliadin has not received any support from our investigations. Neither have we found the later theory, that strength is relative to the amount of gliadin present, invariably holds good, though there is some evidence in its favor from our work. It will be observed that the results both as to gliadin and gliadin ratio are slightly higher for the first three grades than for the last three, though no definite or regular differences are to be noticed as we ascend or descend the scale. Is this falling off in gliadin due to immaturity or the effect of frost? Further work is necessary to show how far this may be the case. Compared with the flours of the 1904 grades, the percentages of gliadin in the present series are higher, the average for the former being 4.76 per cent, for the 1907 flours 5.17 per cent.

Wet and Dry Gluten.—These results follow fairly closely the percentages of protein and are therefore considerably higher than those obtained from the 1904 flour. The averages are for 1904, wet gluten 36.15 per cent, dry gluten 12.61 per cent; for 1907 wet gluten 40.50 per cent, dry gluten 14.40 per cent. It is interesting to observe, however, that the ratio of wet to dry gluten is practically the same for both series viz. 2.86 and 2.81.

The quality of the gluten with the exception of that from No. 6, which was slightly dark, was excellent throughout the series, being firm, elastic and of good colour.

The Water-soluble Constituents of the Flours.

We have already briefly referred (page 12) to the views recently promulgated by Mr. T. B. Wood, of the University of Cambridge regarding the factors that determine strength in flours. As these views were discussed in our Bulletin No. 57, "Quality in Wheat," pages 38, 39, it will not be necessary here to do more than repeat the propositions in very concise form. Mr. Wood concludes from his work that the size of the loaf and the shape of the loaf are determined each by its own separate and distinct factor; that the former is determined by "the amount of sugar contained in the flour together with that formed in the dough by diastatic action," while the latter is dependent upon certain physical properties of the gluten which are in turn consequent upon the presence in varying proportions of certain small quantities of mineral salts, in other words "that strength is associated with a high ratio of proteid to salts and weakness with a low ratio" Mr. Wood says: "It is suggested that the variation of this ratio may be the explanation of the different physical behaviour of the gluten of strong and weak flours, and that this is the factor which determines that component of strength which governs the shape of the loaf and its power of retaining gas." It is upon this latter problem that we have been more particularly engaged in our examination of these flours, and our results may now be presented.

Following the plan outlined by Mr. Wood, 100 grammes of flour were shaken for three hours with 1000 c.c. of distilled water. After standing some time to settle, the supernatant extract was filtered, the operation being hastened by a suction pump, and the filtrate tested to insure the absence of starch. Upon this filtrate the following determinations were made in duplicate; total solids, ash, alkali as potash, phosphoric acid as P_2O_5 and nitrogen. The results are tabulated below:

FLOURS: SOLIDS, ASH, NITROGEN, &c., IN AQUEOUS EXTRACT.

Designation of Sample.	Percentages of Soluble Constituents of Flours.						Baker's Marks.
	Total Solids.	Ash.	Nitrogen.	Alkali as K_2O	Phosphoric acid as P_2O_5	Nitrogen and Ash-free extract.	Volume of loaf.
No. 1 Manitoba Hard.....	5.83	.34	.322	.151	.130	3.65	492
" 1 " Northern.....	6.74	.40	.333	.168	.135	4.37	443
" 2 " "	6.58	.32	.340	.154	.117	4.32	438
" 3 " "	8.31	.44	.335	.184	.131	5.96	383
Commercial Grade No. 4.....	10.99	.43	.355	.184	.133	8.54	397
" " " 5.....	10.59	.49	.359	.199	.171	8.05	366
" " " 6.....	11.91	.52	.392	.201	.145	9.16	363

An increase, though not a regular one, is to be observed in these soluble constituents as we proceed from the first to the last of the series. This increase is most marked in the case of the total solids and nitrogen-and ash-free extract. This seems to show that the larger amount of this increase in the flours of the lower grades is non-nitrogeneous organic matter. If we suppose, as does Mr. Wood, this nitrogen-and ash-free extract to be of the nature of a sugar in so far as gas production is concerned, then according to the theory advanced the volume of the loaf produced should increase pro rata. Such, however, is not the case but rather the reverse, the volume of loaf according to the baker's results, decreasing almost step by step with the grades of the series. This question of the relationship of volume to composition will again be referred to in presenting the data from the sugar determinations; at the moment it will be well to further study the foregoing data with a view of ascertaining

how far Mr. Wood's hypothesis, that shape of loaf is determined by the ratio to proteid of salts, is supported by the results from these flours.

The ratios given in the sub-joined table have been calculated from the percentages of nitrogen and soluble constituents of the flours, and represent the proportion to total nitrogen of soluble ash, alkali (as potash) and phosphoric acid (as P_2O_5).

FLOURS: RATIO TO TOTAL NITROGEN OF SOLUBLE CONSTITUENTS; SHAPE OF LOAF AND STRENGTH.

Designation of Sample.	Total Nitrogen.	Ratio to total Nitrogen of soluble			Baker's Marks.	
		Ash.	Alkali.	Phosphoric acid.	Shape.	Baking Strength.
	%					
No. 1 Manitoba Hard	2.05	6.0	13.5	15.7	.65	95
No. 1 " Northern	2.14	5.3	12.8	15.8	.61	91
No. 2 " Northern	2.18	6.8	14.1	18.6	.62	91
No. 3 " Northern	2.10	4.8	11.4	16.0	.60	83
Commercial Grade No. 4	2.21	5.1	12.0	16.6	.59	84
" " No. 5	2.18	4.4	10.9	12.1	.58	80
" " No. 6	2.11	4.2	10.5	14.5	.59	80

From the baking results obtained by the Cerealist we learn that the figures for the shape of loaf (*i. e.* height divided by diameter) are higher for the first flours than for the last of the series, though the gradation throughout is not quite regular. If the theory is correct that the strength in so far as the shape of loaf is concerned, is controlled by the ratio to the proteid (or total nitrogen) of soluble ash constituents, the ratio increasing with the strength, then we ought to find some agreement between the tabulated ratios and the figures denoting shape. Is there such a relationship? Possibly, for we find higher ratios for the flours at the beginning than for those at the end of the series (as is the case with the results for shape of loaf) but it is evident that the two classes of data are not capable of direct correlation. The irregularities, if such they may be termed, may arise in part from experimental error, but one would scarcely feel justified from the present results in saying that there was a definite, constant relationship between this ratio and the shape of the loaf. The work so far is altogether too limited in extent to make any critical discussion of these apparent irregularities desirable or valuable, but there are indications in these results that have led us to conclude that this phase of the investigation is worthy of further study.

Sugars.—The sugars were determined both in aqueous and alcoholic extracts of the flours, according to the general plan of procedure outlined on page 43, Bulletin No. 57. The results show that water extracts from the flours much larger quantities of the substances reducing Fehling solution and recorded as sugars than does alcohol. That these substances are entirely made up of sugar is extremely doubtful, though they may be of such a nature as to more or less readily yield carbonic acid under the fermenting action of yeast. It is significant that the water-soluble sugars, and more particularly those directly reducing Fehling (recorded as maltose), are markedly higher for the lower members of the series, *i. e.*, in the flours from the wheats showing the effect of frost. This increase agrees very well with the total solids in the water soluble extract discussed in the preceeding paragraph and which, it was observed, furnished much higher percentages for the flours from the lower and "Commercial" grades than for the first three or four of the series. This rise in water-soluble constituents (consisting of sugars or allied bodies) is most probably due to immaturity or the action of frost (the effect of frost being most marked on the lower grades of wheat) and is to be regarded, the writer thinks, as a sign of inferiority from the baker's

point of view. Be this as it may, there is no evidence here that with increase of sugars there is increase of volume in loaf, but rather the reverse. The baker's marks show a most decided falling off in the volume of loaf produced from the frosted wheat flours, as already noted. It would seem from this work that a further study of the water soluble carbohydrates in flours, and especially in flours from frosted and immature wheats, is worthy of attention. It is not improbable that such a research might furnish the explanation for the marked decrease in the volume of loaf.

SUGARS IN FLOUR EXTRACTS

Designation of Sample.	In Aqueous Extract.			In Alcoholic Extract. (70 % alcohol.)			Volume of loaf. (Baker's Marks.)
	Directly reducing, as Maltose.	After inversion, as Sucrose.	Total Sugars.	Directly reducing, as Maltose.	After inversion, as Sucrose.	Total Sugars.	
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	
No. 1 Hard.....	1.96	2.14	4.10	.13	.91	1.04	492
" 1 Northern.....	2.73	1.95	4.68	.20	.94	1.14	443
" 2 "	1.87	1.79	3.66	.18	.87	1.05	438
" 3 "	3.12	2.10	5.22	.26	1.21	1.47	383
" 4 Commercial Grade....	3.62	2.43	6.05	.05	1.34	1.39	397
" 5 " "	3.63	2.43	6.06	.06	1.42	1.48	366
" 6 " "	4.07	2.43	6.50	.06	1.36	1.42	363

Considering the sugars as extracted by 70 p.c. alcohol, we notice a falling off in the percentage of maltose (or sugars calculated as such) in flours from the frosted wheats as compared with the results from the sound flours, but the reverse to be the case with the sugars (or allied compounds) designated as sucrose. It will thus be seen that while there is a fair agreement or rather relationship between the results for sucrose, as obtained from the aqueous and alcoholic extracts respectively, the figures for the maltose (or directly reducing compounds) show no parallelism.

CONCLUSIONS FROM THE CHEMICAL INVESTIGATIONS.

I. The wheat of the past season, as represented by the grades of 1907, is characterized by a decidedly high protein-content. At first sight this might appear to give the wheat a superior rank for bread-making, since it has long been recognized that one of the most important factors in determining the value for bread making is the percentage of protein, *i. e.* gluten, present. Further consideration of the facts, however, warrant some hesitation before drawing such a conclusion. May not the high protein content be in some degree due to immaturity? If so, it would not necessarily, in the opinion of the writer, indicate increased "strength" as applied to bread-making, though it *might* mean a higher value from the nutritive standpoint. Frosted wheat as we have frequently shown is possessed of a higher percentage of protein than similar wheat that has come to a normal ripeness without frost: it is, in other words, immature wheat. It might be argued that this explanation would only apply in a consideration of the lower grades—those showing the effects of frost—but it is not improbable owing to the backward season last year that in some districts at least a considerable amount of wheat was cut in a "greener" condition than usual and that this failed to thoroughly ripen in the stook.

Attention has been called to the slightly higher protein content of the lower grades—a fact which rather strengthens the argument put forward in the preceeding paragraph. The question of immaturity as affecting the "strength" of a flour has not received much

attention at the hands of the chemist or the baker, but it seems more than probable that it will be found one of great importance. Certainly the results presented in this bulletin point in that direction.

II. The relationship of the weight of kernel to the weight per bushel and the percentage of straight grade flour and which we have remarked in former work on the grades of wheat, is not very clearly seen in the 1907 samples. The reason for this is, we presume, the presence of the frosted kernels, especially in the lower grades. As explained, the proportion of straight flour obtained (as judged by colour) will be determined largely by the percentage of immature and frozen kernels, and from the milling results it would appear that this has been a guiding factor in the establishment of those grades showing frosted kernels.

III. The relationship between the protein, gliadin and dry gluten observed in previous work when examining normally ripened wheats is not here apparent. The absence of this relationship probably results from the effect of frost, so observable in the lower grades.

IV. No differentiation of the flours can be made from their protein-content; throughout the series there is no marked departure from the average (12.24 p.c.).

V. The flours of the first three grades give somewhat higher results for gliadin and gliadin ratio than do those of the lower grades. This may point to some relation between maturity and gliadin content, the more fully ripened wheat containing the larger proportion of gliadin. It is significant in this connection that the milling and baking results have led the Cerealist in classifying the wheats to make the first group consist of the three first grades.

VI. The percentages of water-soluble constituents in the flours increase from the first to the last of the series, the increase being chiefly in the nitrogen-and ash-free extract or carbohydrates. This agrees in a measure with the sugar results as obtained from both aqueous and alcoholic solutions, but does not fall into line with the data for the volume of loaf produced. There is here no confirmation of Wood's theory that volume of loaf increases with the percentage of sugar present; indeed the evidence is directly to the contrary. It is, however, only right to add that in this series there may be a disturbing influence from the presence of immature or frosted grain.

The exact nature of the water-soluble carbohydrates of the flours is unknown but is evidently worthy of study. As the volume of loaf is seen to decrease with the increase of this component it seems more than probable that volume is influenced by the amount of soluble constituents, or at all events that such is the case in flours from immature or frosted wheats.

VII. The results of the present series lend some confirmation to Wood's theory that the shape of loaf is influenced by the ratio to the protein (or total nitrogen) of the soluble ash constituents.

UNIVERSITY OF MICHIGAN
3 9015 06701 4129